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SYNTHESIS OF POTENTIAL CORROSION INHIBITORS BASED ON QUATERNARY SALTS OF PYRIDE-CONTAINING AMIDES AND UREAS

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Abstract

A method for the synthesis of quaternary salts of mono- and diquaternized N-arylnicotinamides and ureas as potential inhibitors of acid corrosion is proposed. Available reagents were used in the syntheses: benzyl chloride, allyl bromide, nicotinic acid chlorides, aromatic amines and isocyanates. Preparative yields are 67-87%.

Keywords: corrosion inhibitors, quaternary ammonium salts, N-arylnicotinamides, quaternized and diquaternized salts, quaternized salts based on nicotine-containing ureas.

Materials and methods

IR spectra of the synthesized compounds in KBr tablets were recorded on a Specord-75-JR instrument. PMR spectra were obtained on a JEOL spectrometer (90 MHz) in DMSO- d_6 and $CDCl_3$, chemical shifts were measured in the δ -scale.

N-phenylnicotinamide (9). Dissolve 4 g (0.043 mol) of aniline 6 in 50 ml of dichloroethane, add 12.06 ml (0.086 mol) of triethylamine and 7.6 g of hydrochloric acid (0.043 mol). After boiling for 7 h, wash twice with a dilute solution of soda and three times with water. Dry with sodium sulfate. Filter, wash the precipitate with chloroform. Remove the solvent. Add 250 ml of methanol and activated carbon to the precipitate, boil for 10-15 min. The resulting solution is filtered and the solvent is evaporated under vacuum. The precipitate is recrystallized from acetone. Yield 4.94 g (58%). M.p. = 127°C.

IR (KBr, cm^{-1}): 3365 (NH), 1705 (C=O).

^1H NMR (δ , m.p., $CDCl_3$): 8.43 (1H, s.s., NH), 9.05 (1H, d., $j = 1.0$ Hz), 8.70 (1H, d., $j = 4.0$ Hz), 8.16 (1H, d.d., $j = 6.0$ Hz, $j = 1.0$ Hz), 7.62-7.14 (m., 6H).

3-(N-phenylcarboxamido)-N-benzylpyridinium chloride (12). Dissolve 4.94 g (0.025 mol) of amide 9 in 50 ml of benzene (dry) and add 2.86 ml (0.025 mol) of benzyl chloride. The mixture is boiled for 6 hours and cooled. Then the precipitate is filtered off and washed several times with dry benzene to completely remove benzyl chloride. Dry in air. Yield 5.98 g (74%). Mp = 119°C.

IR (KBr, cm^{-1}): 3340 (NH), 1700 (C=O).

^1H NMR (δ , m.p., DMSO- d_6): 3.28 (2H, c., CH_2), 10.29 (1H, s.s., NH), 9.17 (1H, d., $j = 1.0$ Hz), 8.74 (1H, d.d., $j = 4.0$ Hz, $j = 1.0$ Hz), 8.30 (1H, d.d., $j = 6.0$ Hz, $j = 1.0$ Hz), 7.73-7.08 (m., 11H).

1-Naphthylnicotinamide (10). Dissolve 4 g (0.028 mol) of 1-naphthylamine 7 in 50 ml of dichloroethane, add 7.8 ml (0.056 mol) of triethylamine and 5 g of hydrochloric acid (0.028 mol). After boiling for 7 h, wash twice with dilute sodium hydroxide solution and three times with water. Dry with sodium sulfate. Filter, wash the precipitate with chloroform. Remove the solvent. Add 250 ml of methanol and activated carbon to the precipitate, boil for 10-15 min. The resulting solution is filtered and the solvent is evaporated under vacuum. The precipitate is recrystallized from acetone. Yield 3.53 g (51%). M.p. = 136°C.

IR (KBr, cm^{-1}): 3310 (NH), 1635 (C=O).

^1H NMR (δ , m.p., $CDCl_3$): 8.26 (1H, s.s., NH), 9.20 (1H, d., $j = 1.0$ Hz), 8.79 (1H, d.d., $j = 1.0$ Hz, $j = 4.0$ Hz), 8.26-7.51 (m., 9H).

3-(N-1-naphthylcarboxamido)-N-benzylpyridinium chloride (13). Dissolve 3.53 g (0.012 mol) of amide 10 in 30 ml of benzene (dry) and add 1.632 ml (0.012 mol) of benzyl chloride. The mixture is boiled for 5.5 hours and cooled. Then the precipitate is filtered off and washed several times with dry benzene to completely remove benzyl chloride. Dry in air. Yield 3.57 g (67%). M.p. = 128°C.

IR (KBr, cm^{-1}): 3340 (NH), 1680 (C=O).

^1H NMR (δ , m.ch., DMSO- d_6): 3.71 (2H, c., CH_2), 10.61 (1H, s.s., NH), 9.10 (1H, d., $j = 1.0$ Hz), 8.75 (1H, d.d., $j = 4.0$ Hz, $j = 1.0$ Hz), 8.49-7.48 (m., 14H).

2-Naphthylnicotinamide (11). Dissolve 4 g (0.028 mol) of 2-naphthylamine 8 in 50 ml of dichloroethane, add 7.8 ml (0.056 mol) of triethylamine and 5 g of hydrochloric acid (0.028 mol). After boiling for 7 h, wash twice with a dilute solution of soda and three times with water. Dry with sodium sulfate. Filter, wash the precipitate with chloroform. Remove the solvent. Add 250 ml of methanol and activated carbon to the

precipitate, boil for 10-15 min. The resulting solution is filtered and the methanol is evaporated under vacuum. The precipitate is recrystallized from acetone. Yield 3.04 g (44%). M.p. = 161°C.

IR (KBr, cm^{-1}): 3250 (NH), 1625 (C=O).

^1H NMR (δ , m.h., CDCl_3): 8.43 (1H, s.s., NH), 9.12 (1H, d., $j = 1.0$ Hz), 8.73 (1H, d.d., $j = 1.0$ Hz, $j = 4.0$ Hz), 8.28-7.31 (m., 9H).

3-(N-(2-Naphthylcarboxamido)-N-benzylpyridinium chloride (14). Dissolve 3.04 g (0.012 mol) of amide 11 in 30 ml of benzene (dry) and add 1.376 ml (0.012 mol) of benzyl chloride. The mixture is boiled for 5.5 h and cooled. Then the precipitate is filtered off and washed several times with dry benzene to completely remove benzyl chloride. Dry in air. Yield 3.3 g (72%). M.p. = 148°C.

IR (KBr, cm^{-1}): 3350 (NH), 1670 (C=O).

^1H NMR (δ , m.ch., $\text{DMSO}-d_6$): 3.52 (2H, c., CH_2), 10.80 (1H, s.s., NH), 9.23 (1H, d., $j = 1.0$ Hz), 8.84 (1H, d.d., $j = 4.0$ Hz, $j = 1.0$ Hz), 8.54-7.41 (m., 14H).

3-(N-(2-Naphthylcarboxamido)-N-allylpyridinium bromide (17). Dissolve 3.82 g (0.0154 mol) of amide 11 in 50 ml of benzene (dry) and add 1.33 ml (0.0154 mol) of allyl bromide. The mixture is boiled for 16 h and the solvent is removed. The product is washed with benzene and crystallized from methanol. Yield 4.03 g (71%). M.p. (dec.) = 283°C.

IR (KBr, cm^{-1}): 3350 (NH), 1685 (C=O).

^1H NMR (δ , m.h., $\text{DMSO}-d_6$): 5.85 (2H, c., CH_2), 8.10 (1H, s.s., NH), 6.01-7.95 (m., 14H).

3-(N-phenylcarboxamido)-N-allylpyridinium bromide (18). Dissolve 12.27 g (0.062 mol) of phenylnicotinamide 9 in 60 ml of benzene (dry) and add 5.4 ml (0.062 mol) of allyl bromide. The mixture is boiled for 10 h. A precipitate forms, which is filtered and dried in air. The product is crystallized from ethanol. Yield 16.4 g (83%). M.p. (dec.) = 221°C.

IR (KBr, cm^{-1}): 3350 (NH), 1695 (C=O).

^1H NMR (δ , m.ch., $\text{DMSO}-d_6$): 5.46 (2H, c., CH_2), 8.39 (1H, s.s., NH), 6.28-7.88 (m., 12H).

5-Bromo-2-benzoylamino-N-allylpyridinium bromide (19). Dissolve 6.67 g (0.024 mol) of 5-bromo-2-benzoylaminopyridine 16 in 50 ml of benzene (dry) and add 2.1 ml (0.024 mol) of allyl bromide. The mixture is boiled for 16 h and the solvent is removed. The residue is washed with benzene and crystallized from methanol. Yield 7.28 g (76%). M.p. (dec.) = 238°C.

IR (KBr, cm^{-1}): 3330 (NH), 1650 (C=O).

^1H NMR (δ , m.ch., $\text{DMSO}-d_6$): 8.29 (2H, c., CH_2), 8.94 (1H, s.s., NH), 7.54-7.87 (m., 11H).

N-(2-pyridyl)nicotinamide (25). Dissolve 1.03 g (0.011 mol) of 2-aminopyridine 22 in 50 ml of chloroform (dry), add 3.09 ml (0.022 mol) of triethylamine and 2 g (0.011 mol) of hydrochloric acid. After 8 h of boiling, cool and wash with dilute sodium hydroxide solution. Then the residue is recrystallized from benzene. Yield 0.9 g (41%). M.p. = 144°C.

IR (KBr, cm^{-1}): 3200-2910 (NH), 1650 (C=O).

^1H NMR (δ , m.h., CDCl_3): 9.36 (H5, s.s., NH), 9.14 (H1, d., $j_{1,4} = 1.5$ Hz), 8.75 (CH_2 , d.d., $j_{2,3} = 4.5$ Hz, $j_{2,4} = 1.5$ Hz), 8.31-8.12 (m., H6, H9), 7.74 (H8, $j_{8,9} = 6.5$ Hz, $j_{8,9} = 1.5$ Hz), 7.40 (H3, d.d., $j_{3,4} = 6.5$ Hz, $j_{3,2}$

= 4.5 Hz), 7.29 (H4, d., $j_{4,3} = 6.5$ Hz), 7.04 (H7, d.d., $j_{7,8} = 6.5$ Hz, $j_{7,6} = 4.0$ Hz).

3-(N-(2-pyridyl)carboxamido)pyridyl-N,N-dibenzylpyridinium chloride (28). Dissolve 2.33 g (0.012 mol) of amide 25 in 50 ml of benzene (dry) and add 2.75 ml (0.024 mol) of benzyl chloride. The mixture is boiled for 16 hours and cooled. Then the reaction mixture is filtered and dried in air. Yield 1.78 g (33%). M.p. (dec.) = 129°C.

^1H NMR (δ , m.h., CDCl_3): 9.44 (3H, m.s., NH, CH_2), 8.22 (7H, m., CH_2 , Ph), 7.03 (3H, m., Ph), 7.38 (3H, m., Ph, Py), 7.74 (2H, m., Py), 8.76 (2H, m., Py), 9.18 (3H, m., Py).

N-4-pyridylnicotinamide (26). Dissolve 3 g (0.03 mol) of 4-aminopyridine 23 in 50 ml of chloroform (dry), add 8.4 ml (0.06 mol) of triethylamine and 5.4 g (0.03 mol) of hydrochloric acid. After 6 h of boiling, the reaction mixture is cooled and treated with a dilute solution of NaOH (10%), washed with water until neutral and dried with sodium sulfate. Then the chloroform is evaporated. Yield 4.82 g (38%). M.p. = 186°C.

^1H NMR (δ , m.p., CDCl_3): 9.51 (1H, s.s., NH), 8.32 (2H, d., $j = 6.0$ Hz), 8.11 (1H, s.), 7.83 (1H, d., $j = 6.5$ Hz), 7.57 (2H, d., $j = 6.0$ Hz), 7.52-7.28 (2H).

3-(N-(4-pyridyl)carboxamido)pyridyl-N,N-dibenzylpyridinium chloride (29). Dissolve 4 g (0.02 mol) of amide 26 in 50 ml of benzene (dry) and add 4.59 ml (0.04 mol) of benzyl chloride. The mixture is boiled for 16 hours and cooled. Then the reaction mixture is filtered and dried in air. Yield 2.99 g (44%). M.p. (dec.) = 174°C.

^1H NMR (δ , m.h., CDCl_3): 9.63 (3H, s.s., NH, CH_2), 8.52 (2H, d., $j = 6.5$ Hz), 8.24 (m., 7H), 7.87 (2H, d., $j = 6.5$ Hz), 7.29 (m., 7H), 5.91 (2H, s., CH_2).

N-3-quinolylnicotinamide (27). Dissolve 3.97 g (0.027 mol) of 3-aminoquinoline 24 in 100 ml of chloroform (dry) and add 4.9 g (0.027 mol) of hydrochloric acid. After 9 hours of boiling, a precipitate forms, which is filtered off and dissolved in a minimum amount of water. Then, excess KOH is added, a precipitate forms upon cooling. After that, the substance is filtered off and dried in air. Yield 4.06 g (62%). M.p. = 152°C.

IR (KBr, cm^{-1}): 3330-3050 (NH), 1640 (C=O).

^1H NMR (δ , m.p., CDCl_3): 9.87 (1H, s.s., NH), 9.13 (1H, s., CH), 8.92 (1H, s., CH), 8.34 (1H, d., $j = 6.0$ Hz), 7.94-7.41 (m., 7H).

3-(N-(3-quinolyl-N-benzylquinolilium chloride)carboxamido)pyridyl-N-benzylpyridinium chloride (30). Dissolve 3.56 g (0.014 mol) of amide 27 in 100 ml of chloroform (dry) and add 3.21 ml (0.028 mol) of benzyl chloride. After boiling for 10 hours, the chloroform is evaporated. Yield 6.23 g (87%). M.p. (with decomp.) = 136°C.

^1H NMR (δ , m.p., $\text{DMSO}-d_6$): 10.19 (1H, s.s., NH), 9.44 (2H, s.s., CH_2), 8.10-7.42 (m., 13H), 6.05 (2H, s., CH_2).

N'-(2-pyridyl)-N''-(phenyl)urea (31). Dissolve 5.0 g (0.05 mol) of 2-aminopyridine 22 in 50 ml of benzene (dry) and add 5.7 ml (0.05 mol) of isocyanate. The reaction occurs instantaneously upon heating – a white precipitate is formed. Then the reaction mixture is

filtered, the precipitate is dried in air. Yield 10.83 g (96%). M.p. = 192°C.

IR (KBr, cm^{-1}): 3200-2910 (NH), 1690 (C=O).

^1H NMR (δ , m.h., CDCl_3): 11.31 (1H, s.s., NH), 10.21 (1H, s., NH), 8.21 (1H, d., $j = 7.7$ Hz), 7.75-6.93 (m., 8H).

N'-(2-pyridyl)-N-benzylpyridinium chloride)-N''-(phenyl)urea (33). Dissolve 5.0 g (0.0235 mol) of urea 31 in 27 ml (0.2354 mol) of benzyl chloride and boil for 20 hours. Next, extract by mixing the reaction mass with water and methylene. Then, evaporate the water from the aqueous layer. Yield 4.72 g (59%). M.p. (dec.) = 179°C.

^1H NMR (δ , m.p., CDCl_3): 10.45 (1H, s.s., NH), 9.20 (1H, s.s., NH), 7.93 (1H, d., $j = 6.8$ Hz, CH_2), 7.50-6.71 (m., 14H), 4.57 (1H, d., $j = 6.8$ Hz, CH_2).

N'-(4-pyridyl)-N''-(phenyl)urea (32). Dissolve 5.0 g (0.05 mol) of 4-aminopyridine 25 in 50 ml of chloroform (dry) and add 5.7 ml (0.05 mol) of isocyanate. After 8 hours of boiling, the chloroform is evaporated and the product is dried in air. Yield 11.15 g (99%). M.p. = 247°C.

IR (KBr, cm^{-1}): 3270-2960 (NH), 1800 (C=O).

^1H NMR (δ , m.c., CDCl_3): 8.50 (1H, br.s., NH), 8.25 (2H, d., $j = 6.4$ Hz), 7.63-6.93 (m., 8H).

N'-(4-pyridyl)-N-benzylpyridinium chloride)-N''-(phenyl)urea (34). Dissolve 11.27 g (0.053 mol) of urea 32 in 120 ml of chloroform (dry), add 6.08 ml (0.053 mol) of benzyl chloride and boil for 10 hours. Then the resulting substance is filtered off and left to dry in air. Yield 13.82 g (77%). M.p. (dec.) = 225°C.

IR (KBr, cm^{-1}): 3270-2960 (NH), 1750 (C=O).

^1H NMR (δ , m.ch., CDCl_3): 11.91 (1H, s.s., NH), 9.58 (1H, s.s., NH), 8.40 (2H, d., $j = 7.0$ Hz), 8.02 (2H, d., $j = 7.0$ Hz), 7.67-6.95 (m., 10H), 5.49 (2H, p., CH_2).

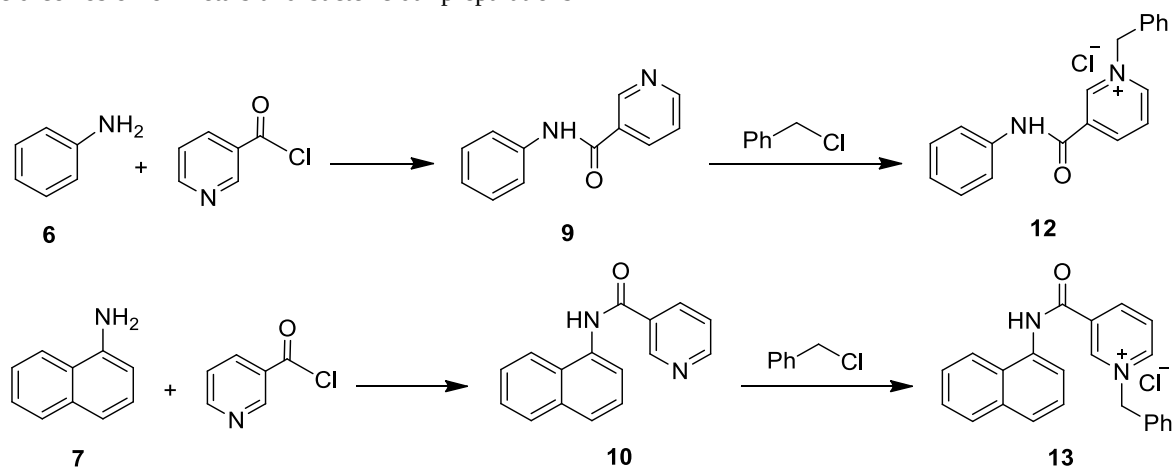
Results and discussion.

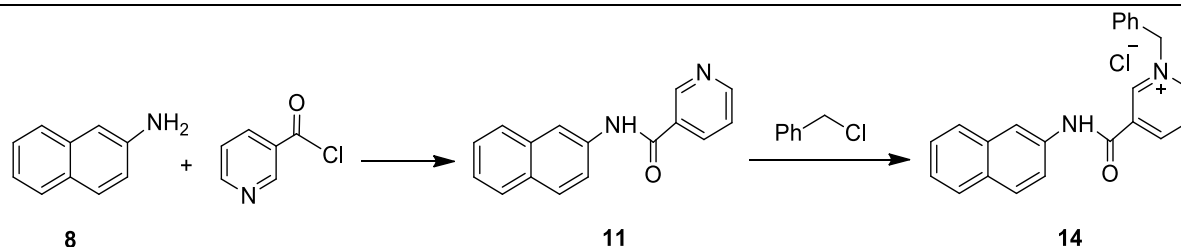
The search for effective adsorption inhibitors of acid corrosion of metals and bactericidal preparations

is an urgent task. The compounds used to create the specified industrial reagents include quaternary ammonium salts. For example, it is known [1] that the greatest anti-corrosion effect is exhibited by such quaternary ammonium salts, in the structure of which, in addition to the adsorption center - the quaternary nitrogen atom - there are several adsorption centers of different types: nitrogen atoms with a free pair of electrons, oxo groups, which are characterized by donor-acceptor interaction with the metal surface. The creation of such additional adsorption centers allows obtaining compounds, the action of which as corrosion inhibitors can be enhanced by combining several inhibitory effects. Quaternary ammonium salts are also part of disinfectants for medical and household purposes [2]. It is known that quaternary salts of the pyridine series have a wide range of useful properties. First of all, it is necessary to emphasize their use in technological processes as inhibitors of acid corrosion of metals and antimicrobial drugs [3, 4]. For the development of new promising technologies, it is necessary to develop measures to protect metals from corrosion, and the emergence of resistance in microorganisms to existing bactericides requires the use of new, more effective disinfectants. In this regard, it becomes important to obtain new quaternary salts of the pyridine series, which have the specified properties, based on available and cheap reagents.

1. Synthesis of monoquaternized amides

N-phenylnicotinamide 9, 1-naphthyl nicotinamide 10 and 2-naphthyl nicotinamide 11 were obtained by acylation of aniline 6, 1-naphthylamine 7 and 2-naphthylamine 8 with nicotinic acid chloride, respectively. For the experiments, reagents of the "pure" brand were used. Quaternization of 9-11 with benzyl chloride was carried out in benzene, the yield of salts 12-14 was 67-74%

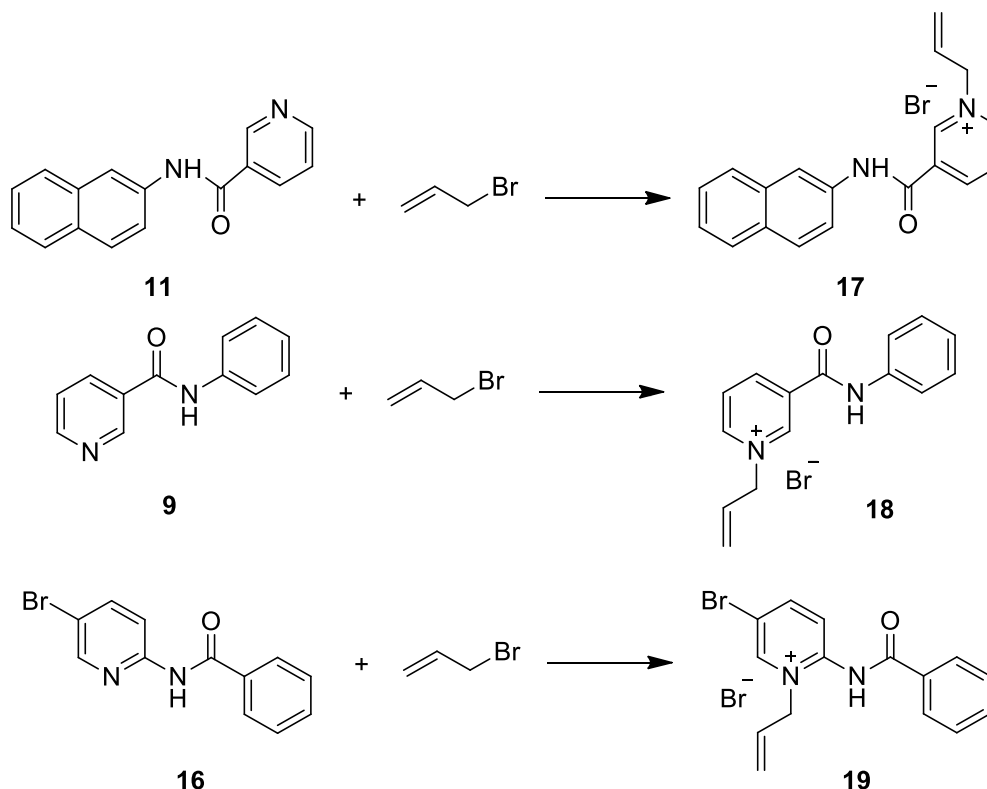




The synthesized salts were purified by recrystallization from benzene. Confirmation of the structure of salts 12-14 was carried out using IR and PMR spectra. Absorption bands characteristic of the amide group are present in the IR spectra at frequencies of 3340-3350 and 1670-1700 cm^{-1} . In the PMR spectra of these salts

there are signals of protons of the NH group at 10.29-10.75 m.p. and methylene protons of the benzyl radical at 3.28-3.71 m.p.

The following substituted N-allylpyridinium bromides were also synthesized:

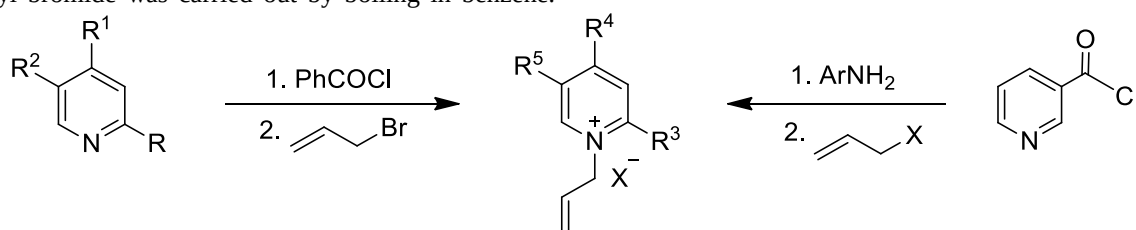


signals of the NH N-arylnicotinamides 11 and 9 were synthesized by acylation of aniline and 2-naphthylamine with nicotinic acid chloride in benzene. Benzoylaminopyridine 16, required for quaternization, was obtained by boiling a mixture of benzoyl chloride and the corresponding amine in a 1 : 1 ratio in chloroform and purified by recrystallization from benzene. Allyl bromide was used for quaternization of N-arylnicotinamides 11 and 9.

Quaternization of benzoylaminopyridine 16 with allyl bromide was carried out by boiling in benzene.

The structure of the compounds was confirmed by IR and PMR spectra. Absorption bands characteristic of the amide group appear in the IR spectra at 1650-1695 (C=O), 3330-3350 (NH) cm^{-1} . The PMR spectra contain -group proton at 8.1-8.9 ppm, methylene protons of the allyl radical at 5.24-5.9 for salts 17 and 18 and at 8.3 for salt 19.

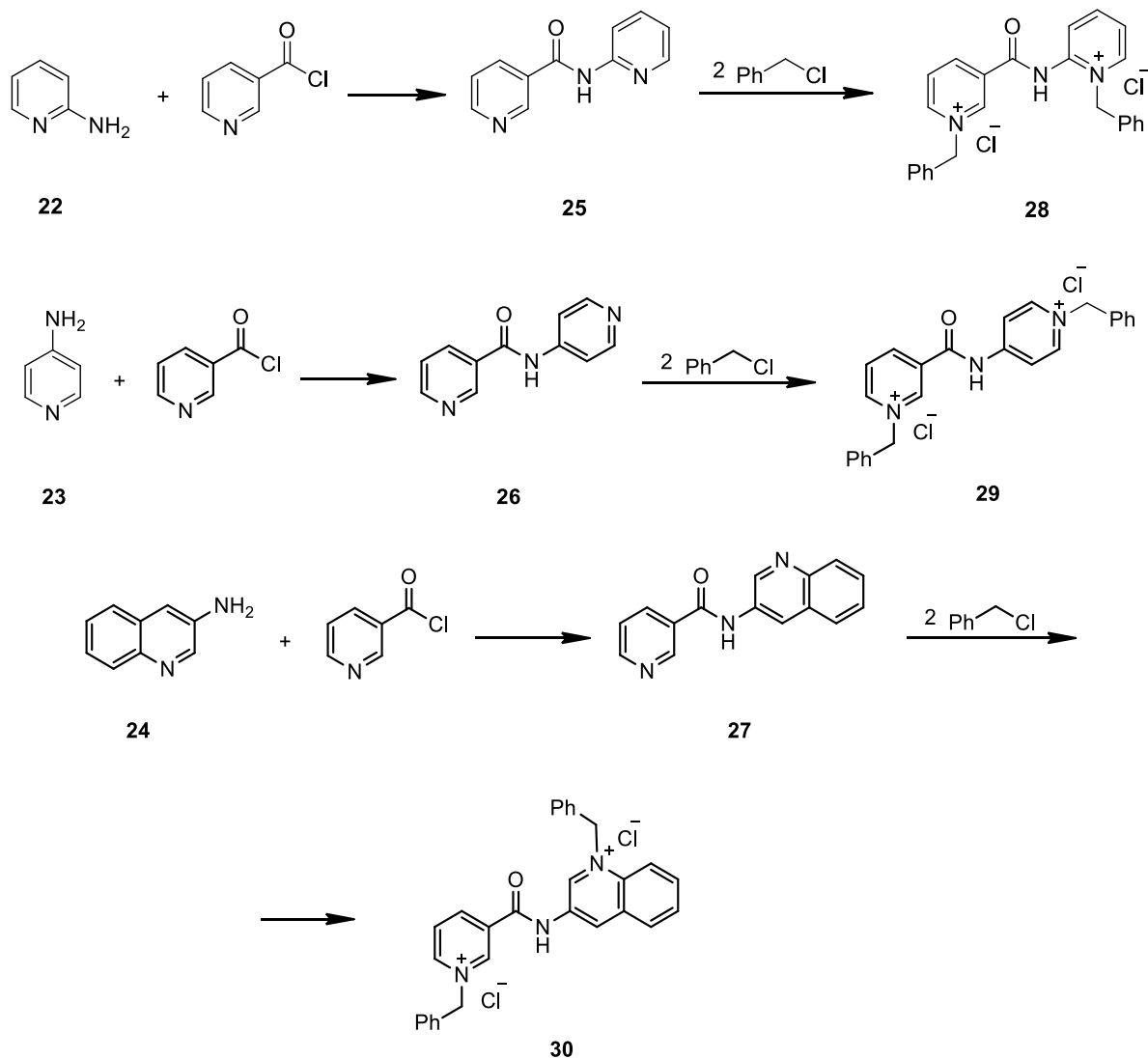
The synthesis of substituted N-allylpyridinium halides was carried out according to the general scheme:



2. Synthesis of diquaternized amides

N-2-pyridylnicotinamide 25, N-4-pyridylnicotinamide 26 and N-3-quinolylnicotinamide 27 were obtained by acylation of 2-aminopyridine 22, 4-aminopyridine 23 and 3-aminoquinoline 24 with nicotinic acid chloride, respectively. Quaternization of 25-27 with benzyl chloride was carried out in benzene or chloroform. The yield of the synthesized salts 28-30 is 33-87%.

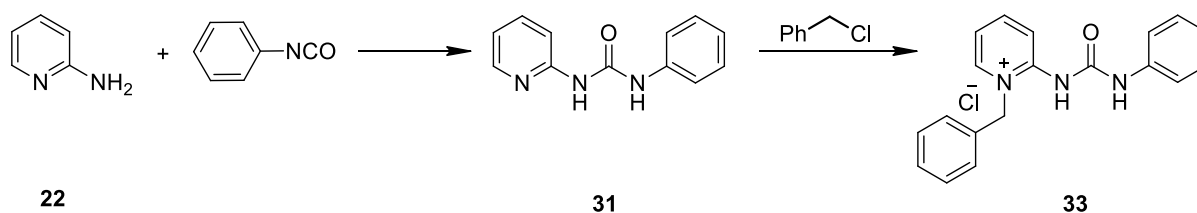
Confirmation of the structure of salts 28-30 was carried out using PMR spectra. Characteristic signals of protons of the NH group at 9.44-10.19 ppm and methylene protons of the benzyl radical at 9.44-6.05 ppm are present. The latter is possibly explained by the fact that the mutual influence of protons of CH₂ groups leads to their shift into a weaker field.

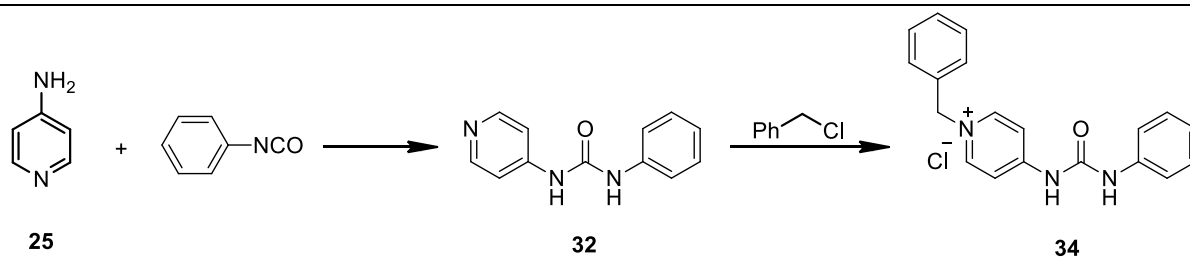


3. Synthesis of urea-based salts

N'-(2-pyridyl)-N''-(phenyl)urea 31 and N'-(4-pyridyl)-N''-(phenyl)urea 32 were obtained by the interaction of phenylisocyanate with 2-aminopyridine 22 and 4-aminopyridine 25, respectively. "Pure" reagents

were used for the experiments. Quaternization of 31 and 32 with benzyl chloride was carried out in chloroform, the yield of salts 33 and 34 was 59-77%.





The structure of salts 33 and 34 was confirmed by IR and PMR spectra. In the PMR spectra of these salts there are signals of protons of the NH group at 11.91-9.20 m.p. and methylene protons of the benzyl radical at 7.93-4.57 m.p. Absorption bands characteristic of the diamidocarbonate group are present in the IR spectrum of salt 34 at frequencies of 3270-2960 (NH) and 1750 (C=O) cm⁻¹.

Conclusions

1. A method for the synthesis of quaternary salts of mono- and diquaternized N-arylnicotinamides and ureas as potential inhibitors of acid corrosion is proposed. Available reagents were used in the syntheses: benzyl chloride, allyl bromide, nicotinic acid chlorides,

aromatic amines and isocyanates. Preparative yields are 67-87%.

2. All synthesized substances will be tested as corrosion inhibitors and antibacterial drugs.

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ECONOMIC SCIENCES

CONSIDERATION OF SUSTAINABLE DEVELOPMENT REQUIREMENTS IN DESIGNING AND CONSTRUCTING HOUSING IN THE MOUNTAIN AREAS OF TAJIKISTAN

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УЧЁТ ТРЕБОВАНИЙ УСТОЙЧИВОГО РАЗВИТИЯ В ПРОЕКТИРОВАНИИ И СТРОИТЕЛЬСТВЕ ЖИЛЬЯ НА ГОРНЫХ ТЕРРИТОРИЯХ ТАДЖИКИСТАНА

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Abstract

The vulnerability of mountainous areas to natural and man-made impacts worsens living conditions and farming in the mountains, limits living conditions and leads to a significant lag in economic and social development. The difficulties and limitations of building residential premises in mountain settlements are described, and the need to preserve historically established technologies and materials used in construction as examples of national identity is substantiated.

Аннотация

Уязвимость горных территорий к природным и техногенным воздействиям ухудшает условия проживания и ведения сельского хозяйства в горах, ограничивает условия жизни и приводит к существенному отставанию в экономическом и социальном развитии. Описаны трудности и ограничения строительства жилых помещений в горных поселениях, обоснована необходимость сохранения исторически сложившихся технологий и материалов, используемых в строительстве, как образцов национальной идентичности.

Keywords: mountainous areas, sustainable development, difficulties and limitations in housing construction, national identity

Ключевые слова: горные районы, устойчивое развитие, трудности и ограничения в жилищном строительстве, национальная идентичность

Каждая горная страна, имеет свои характерные особенности, исторически сформировавшиеся на протяжении многих веков, среди которых наряду с методами и способами ведения натурального хозяйства в горах, также и строительство жилых помещений, адаптированных к суровым природно-климатическим условиям.

В настоящее время специалистами признается, что горные территории играют важную роль в развитии мировой экономики, глобальных коммуникационных системах, рекреации, в сохранении стабильности социальной и политической жизни мирового сообщества в целом. Ученые и эксперты сходятся во мнении, что в XXI веке будет наблю-

даться глобальный экологический кризис, существенной частью которого станет непрерывно возрастающая антропогенная нагрузка, в том числе в горах и предгорьях, где эти непоправимые нарушения механизма естественного воспроизводства и стабилизации окружающей среды будет особенно болезненным и может привести к катастрофе планетарного масштаба.

Так, уязвимость горных экосистем к природным и техногенным воздействиям является причиной возникновения многих экологических процессов, характерных для горных и предгорных территорий. К главным из них можно отнести изменение климата, таяние ледников, сокращение площадей

растительности, уменьшение биологического разнообразия, дефицит пресной воды и др. Наличие этих факторов усугубляет жизнь и ведение хозяйства в горах и существенно ограничивает жилищно-бытовые условия для проживания. В целом это приводит к значительному отставанию экономического и социального развития этих территорий. По данным ООН, горные экосистемы занимают одну пятую часть поверхности Земли и здесь проживают около 10% населения мира. По данным Д. В. Черных и В. И. Булатова [11], если обратиться к картометрическим работам, позволяющим создать наиболее точный портрет поверхности Земли по определенным высотным интервалам, то из данных Цюрихского Института картографии следует, что 48% суши планеты лежат выше 500 м над уровнем моря. Выше 1000 м расположены 27%, 2000 м - 11, 3000 м - 5%. высокогорья более 4000 м составляют 2 %. А по данным Е.А. Белоновской и А.А. Тишкова [4], в настоящее время в мире из 785 млн га охраняемых природных территорий мира 264 млн га или 33,7% находятся в горах и из 1200 заповедников 473 (39,4%), соответствующих статусу горных.

В свете этих данных, Республика Таджикистан является типично горной страной и имеет отметки абсолютных высот от 300 до 7495 м. Немаловажно, что половина из 93% территории республики, занимающими горами, расположена на высоте более 3000 м. При этом, абсолютное большинство этой территории находится в зоне высокой сейсмической активности с землетрясениями интенсивностью 7,8 и более баллов, с резкими климатическими изменениями и др., следствием которых становятся многочисленные стихийные бедствия. Своеобразные природно-климатические условия этих территорий породили уникальные, тысячелетиями сложившиеся социальные, этнические, культурные и экономические традиции, на которых отрицательно сказываются катаклизмы последних десятилетий. Таким образом, для сохранения и дальнейшего социально-экономического развития горных территорий Республики Таджикистан, требуется учет особых условий, среди которых:

- уязвимость горных систем к природным и техногенным воздействиям;
- тяжёлые климатические условия;
- жёсткие условия сельскохозяйственной деятельности;
- высокие энергетические и материально-технические затраты жизнеобеспечения;
- слаборазвитая инфраструктура и ограниченность доступа к обычным социально-экономическим услугам и др.

Комплексный учет перечисленных факторов в социально-экономическом развитии горной территории предусматривает, что устойчивым сбалансированным механизмом, в котором все процессы должны быть взаимосвязанными, а возникающие противоречия взаимоисключаемыми. Данная проблема является актуальной и в связи с концепцией и стратегией устойчивого развития, предложенной

Всемирной комиссией ООН по охране окружающей среды под руководством Брундтланд, прозвучавшей в ее докладе «Наше общее будущее» в 1987 г. При этом, в докладе было отмечено, что темпы производства и потребления в мире так резко выросли, что это негативно сказывается на состоянии окружающей среды, сформулировано определение понятия устойчивого развития (УР) как «такого движения вперед, когда человечество удовлетворяет свои жизненные потребности, не лишая этой возможности будущие поколения». В этом же докладе впервые был обозначен проект концепции устойчивого развития, подразумевающего взаимосвязь и неразрывность трех компонентов: социальной, экономической и экологической.

В Республике Таджикистан, несмотря на стабильное из года в год увеличение в государственном бюджете объемов финансирования социальных сфер, природно-ресурсный и этнокультурный потенциал горных территорий не получает в должной мере государственную поддержку и имеет отчетливо выраженные тенденции к снижению и деградации [7 с.101]. В целом, горные территории республики значительно отстают в экономическом и социальном развитии по сравнению с равнинными по ряду причин, главными из которых являются отсутствие промышленной и научно-технической составляющих роста.

В ежегодном Послании Президента Республики Таджикистан Эмомали Рахмона от 28 декабря 2024 года «Об основных направлениях внутренней и внешней политики республики» отмечено, что "...путем осуществления национальных целей, прежде всего, обеспечивать национальную безопасность и устойчивое экономическое развитие, таким образом еще больше повышать уровень и улучшать качество жизни народа. Наш народ, как и другие жители цивилизованных стран, имеют моральное право на достойную жизнь" [1], что безусловно относится к горным и предгорным территориям. При этом подразумевается, что в процессе удовлетворения своих производственных, бытовых и рекреационных интересов, общество должно обеспечить эффективное использование природно-рекреационного потенциала гармоничным отношением к окружающей природной средой сбалансированным социальным, экономическим и экологическим потреблением.

Принципиальным следует также признать, что динамика развития горных систем не всегда на деле может совпадать с тенденциями развития ее основных компонентов. Так, отсутствие четко сформулированной политики развития горных регионов на местах, являющееся во многом следствием недостаточности разработок государственной программы регионального развития горных территорий, может обострить проблему.

В Республике Таджикистан, оказавшейся наряду с другими странами в затяжном социально-экологическом кризисе, глубина и динамика кризисных явлений для уязвимых высокогорных территорий оказалась более болезненной. Сказанное делает актуальным решение социальных проблем

на уровне этих регионов путем переноса центра тяжести социальной защите с государственного уровня на регионы [7 с.102]. Связано это с тем, что на уровне региона могут быть наиболее полно учтены социально-экономические, природные, демографические, экологические и другие особенности горных территорий. Так, несмотря на то, что задача освоения и развития горной зоны в Республике Таджикистан всегда стояла на первом плане, предвидеть и избежать обострения противоречий в развитии этого сектора экономики в настоящее время не представляется возможным. В первую очередь одним из ограничивающих факторов развития этих территорий, несмотря на наличие ряда преимуществ и возможностей по производству экологически чистых продуктов, является, на наш взгляд, отсутствие в условиях новых форм рыночной экономики и появления различных современных технологий целевой государственной поддержки коммерческой деятельности местных предприятий.

При нынешних темпах освоения горных и предгорных районов часто забывается, что горные системы сложны и хрупки: динамичность рельефа, эрозия почв, высокая сейсмичность, оползни, лавины, стремительные потоки воды, падение скал – всё это вызывает изменения экологической ситуации и, следовательно, влияет на условия жизнедеятельности человека. При этом, не вызывает сомнений, что устойчивое развитие горных территорий необходимо для того, чтобы последующие поколения могли иметь возможность пользоваться ресурсами гор, которые должны служить в государстве стратегическими зонами интересов страны с достаточным потенциалом в хозяйственном, экономическом и социальном развитии.

Следует признать, что теория устойчивого развития горных социально-экономических систем находится в целом в стадии становления. Так, до сих пор в данном научном направлении остается много спорных и нерешенных вопросов, нет четкого единства в понимании «устойчивость» и в чем смысл «устойчивого развития» и что понимать под «устойчивым ростом». Современной наукой до сих пор не выработано единого определения категории устойчивости самой социально-экономической системы, не определены критерии устойчивости сложных, экологически и экономически уязвимых территорий к которым относятся горные социально-экономические системы, а сам горный район, его население и окружающая среда как единое целое остаются вне поля зрения исследователей и управленцев.

В настоящее время наблюдается стабильный рост стихийного индивидуального жилищного строительства практически в каждом горном районе республики, возводимым местным населением за счет собственных средств и характеризуемого наличием ряда трудностей и ограничений объективного и субъективного характера.

К объективным следует отнести, например, учет в проектах степени сложности производимых строительно-монтажных работ, приводящих к

усложнению технологий производства работ и соответствующего удорожания строительства. Также дополнительными и усложняющими факторами при обосновании проектных решений является высокая сейсмическая опасность горных территорий, а также учет опасных инженерно-геологических явлений в виде склоново-гравитационных процессов, оползней, обвалов и камнепадов, селевых потоков, овражной эрозии и др.

Однако, следует признать наличие противоречия между сохранившимися до настоящего времени, характерного для данной местности тысячелетнего уклада и традиций горных жителей, особенно в строительстве жилых помещений с использованием местных строительных материалов, наилучшим образом учитывающих местные геологические и климатические особенности с появления в технологии местного домостроения новых технологий, инструментов и материалов.

Кроме этого, многие строящиеся по традиционным технологиям жилые дома не учитывают изменившиеся климатические условия, требований по сейсмике, грунтовых и гидрогеологических условий, а также на задний план отходят такие проблемы, как экологии, требования охраны водных ресурсов и атмосфера, утилизации бытового мусора и пр.

Анализ показывает, что приостановить стихийный процесс роста индивидуального жилищного строительства в горных селениях, в большинстве своем возводимых местным населением за счет собственных средств членов семьи, зарабатывать в тяжелых условиях зарубежной миграции и требовать соблюдения каких-то требований, в том числе соблюдения условий сейсмике и технологии строительства, технических условий эксплуатации построенных домов и пр., не представляется возможным.

Таким образом, с целью обеспечения улучшения жилищно-бытовых условий населения горных территорий представляет интерес внедрение на предварительной стадии проектного обоснования намечаемого проекта строительства на горных территориях в составе проекта раздела оценки градостроительной уязвимости данной территории. На наш взгляд данная оценка должна обеспечить комплексный учет большого количества факторов: от характеристики рельефа местности и традиционных демографических показателей до основных объектов риска для населения, жилым и общественным зданиям, объектам инфраструктуры и пр.

С целью обеспечения устойчивого развития горных территорий Республики Таджикистан при жилищном строительстве, немаловажно наряду с внедрением современных инновационных проектов жилищного строительства и выстраивания новых методов в проектировании и строительстве, необходима разработка комплекса разрешительно-принудительных механизмов и ограничений, связанных с необходимостью сохранения исторической ценности отдельных старинных домов и посе-

лений, представляющих национальную идентичность в градостроительстве в горах. обеспечения устойчивого развития наших горных территорий.

Если учесть также отсутствие заинтересованности в использовании современных инновационных технологий, внедрения преобразований в методах социально-экономического развития уязвимых горных территорий, в том числе в технологии и организации малоэтажного строительства, актуальнейшей становится также задача разработки инновационных научных концепций эффективного использования особенностей градостроительства на горных территориях при реконструкции и новом строительстве, в том числе зданий и сооружений частной застройки.

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DIRECTIONS FOR IMPROVING THE EFFICIENCY OF SERVICES IN THE BANKING SECTOR IN THE CONTEXT OF DIGITAL TRANSFORMATION**Khasanova Kh.**

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Abstract

The article discusses the features of changes in banking activities in the context of the digital economy. Digitalization of the economy and the introduction of digital technologies have had a huge impact on current production and lifestyle. At the same time, the importance of digital transformation of banks is reflected not only in increasing efficiency and financial indicators, but also non-economic indicators of commercial banks. Priority areas for achieving increased efficiency of banking services and customer retention through remote servicing of the banking sector through the use of innovative technologies are presented.

Keywords: digital transformation, remote services, innovative technologies, banking sector, service efficiency, mobile banking, Internet banking, blockchain.

Introduction

The process of digital transformation requires special changes for all economic systems, as well as for the banking sector, which forms the financial sector within these systems.

With the influx of digital innovations into the financial sector, commercial banks are actively or passively undergoing digital transformation. Accelerating the digital transformation of the financial sector, this leads to an increase in the income of commercial banks and an increase in the efficiency of banking activities.

According to the legislation of Uzbekistan, a bank is a legal entity that carries out a set of operations defined as banking activities for opening and maintaining bank accounts, making payments, attracting funds into deposits (deposits), issuing loans on its own behalf [1].

It is evident that the spread of financial technologies and financial innovations has contributed to the acceleration of digital transformation in the banking sector. Thanks to the digital transformation of banks, the efficiency of lending in banks has accelerated, the efficiency of enterprise financing has increased by reducing the level of risk management and control, and recently, scientists have studied the digital transformation of banks from the perspective of financial innovation technologies and found that the digital transformation of banks has improved the efficiency of banking operations and financial performance of commercial banks, they emphasized that it is aimed at further improvement.

Theoretical aspects of research.

Digital transformation of the banking industry will improve the efficiency of commercial banks, improve

the service model of traditional commercial banks, and thereby help transform and modernize commercial banks. The introduction of digital technologies can be implemented faster and more efficiently in large commercial banks than in small commercial banks.

Russian economist N.I. Likhodeeva defined the system of remote servicing of a bank account as a technology for providing banking services to a client using computer technology without visiting the bank, that is, on the basis of remote orders.

Digitization is the renewal of an organization using new information and communication technologies. According to Matt, digital transformation is a complex process that includes: changes in value creation, structural changes, the use of technology and financial aspects, and is aimed at solving the problems that banks are currently facing. Digital transformation is blocked by a number of obstacles that can hinder or even destroy this process. Based on the established regulatory standards known as Basel III, banks are seeking to transition to new technology standards, such as Regulatory Technology (RegTech), which facilitate the digital transition. RegTech is an emerging trend that uses information technology and digital innovations to greatly assist the process of managing banking regulations.

The terms “challenger bank” and “neobank” are often used interchangeably, but a bank can offer everything from simple transactional lending to small business lending. And as a result, it’s hard to tell the difference between all the digital banks using these devices. Here’s one way to classify current digital challenger banks based on their business models and the services they provide.

1-table. Different types of digital banks¹

New banks	New banks have full banking licenses and are direct competitors to major banks, offering the same services as traditional banks. Examples include Monzo, N26, Starling Bank, and Revolut.
Neo banks	Neo banks do not have a banking license, but partner with financial institutions to offer licensed services. Typically, neo banks still require customers to have an account with an existing licensed bank, and then they offer a more user-friendly interface and free services. Tencent's WeBank, Yolt, Lunarway, and Moven are examples of neo banks.
Beta banks	Beta banks are joint ventures or subsidiaries of existing banks that offer financial services under a license from the parent company. Beta banks are often created to enter new markets by offering limited services but to a wider range of consumers. Examples of beta banks include AiBank (a joint venture between China's CITIC Bank Corp and search giant Baidu) and Simple (a partnership between Bancorp and BBVA).
Nonbanks	Non-banks are not subject to traditional banking licenses. Instead, they provide financial services in other ways. This unique model allows the company to operate independently of existing banks. For example, Monese operates under an e-money license.

We should note more that innovative development is the main opportunity to increase the efficiency of banks. The theory and practice of using digital technologies in the world's leading countries has a significant impact on the functioning of the modern banking system. This phenomenon is typical for the leading five countries as well as for developing countries, which is confirmed by many analytical reviews and fundamental studies of various scientists. In particular, S. Carbo-Valverde, K. Kahn analyzed the efficiency of the American and European payment systems, emphasized the role of online banking products and did not see them as a threat from cryptocurrency. T. Akhisar, K. Tunay emphasize that the effectiveness of electronic banking services is increasing. A study conducted by F. Libana-Cabanillas in Spain shows that the interest of companies and people in this segment is increasing. Electronic banking is actively developing in Asia, Africa and the Middle East.

Research methodology.

The research is based on the tools of economic theory, banking, risk theory and security methodology. In the process of conducting the research, general scientific methods were used - analysis and synthesis, induction and deduction, systematic and comparative analysis, economic and statistical methods, as well as the methods of correlation of theory and practice, comparison and analogy.

Foreign experience of research.

During our research we have analyzed foreign experiences that illustrate directions for improving the efficiency of services in the banking sector through digital transformation such as Romania's Digital Banking Transformation-Romania is actively transforming its banking sector by adopting emerging technologies and innovations. The COVID-19 pandemic accelerated the shift towards digital banking, emphasizing the need for banks to enhance their operational capacity and customer service through digital means. The integration of artificial intelligence and machine learning has improved investment strategies and customer relationship management, indicating a strong correlation between digitalization and the financial stability of banks in Romania².

A comprehensive bibliometric review highlighted that countries like the UK, USA, Germany, and China are at the forefront of research in digital banking transformation. The study identified key trends such as the rise of FinTech, blockchain technology, and mobile banking services. This research underscores the importance of understanding digital client behavior and preferences to enhance service delivery in banking³.

Research has identified three distinct phases in the digital transformation journey of banks: digitization, digitalization, and digital transformation. Each phase has specific characteristics and requires distinct actions to progress. This structured approach helps banks track their digital maturity and implement effective strategies to enhance service efficiency. The emergence of FinTech companies has significantly disrupted traditional banking models. Banks are increasingly investing in digital initiatives to meet evolving customer needs and expectations. This shift towards digitalization is essential for maintaining competitiveness and preventing the commoditization of banking services⁴.

The globalization of banking services has opened new markets and opportunities, enhancing profitability for banks that effectively navigate these changes. The integration of technology into banking operations has led to improved efficiency and customer satisfaction, demonstrating the need for banks to adapt to a rapidly changing digital landscape. These experiences highlight the critical role of digital transformation in enhancing the efficiency of banking services, emphasizing the need for banks to adopt innovative technologies and strategies to remain competitive in the global market.

Analyze and result of research.

Digital transformation of the financial sector means the continuous expansion and application of artificial intelligence and cloud technologies, that is, digital technologies represented by big data, business optimization, modernization and the process of accelerating innovative transformation in commercial banks. By providing remote services, it helps improve operational efficiency, stimulate innovation and reduce costs in the banking sector. Also, technically, the digital transfor-

¹ Prepared by the author.

² <https://www.mdpi.com/2079-8954/11/11/534>

³ <https://www.mdpi.com/2079-9292/13/22/4383>

⁴ <https://ideas.repec.org/a/ovi/oviste/vxxiiy2023i1p1112-1122.html>

mation of banks is based on the development of information technology, at the same time, smart robots have appeared that increase the efficiency of service based on artificial intelligence; cloud flash payments based on the Internet of Things technology have appeared; the use of blockchain technology in the banking sector is the most effective. To make a payment using blockchain technology, it is enough to have a minimum level of information about the payer, for example, to know that there are enough funds in his account to make a payment. The emergence and application of various innovative technologies have increased the operational capabilities of banks and reduced banking costs. At the same time, digital transformation has provided an opportunity for commercial banks to carry out operational activities with high efficiency and low costs.

As a result of the introduction of innovative technologies and continuous technological improvement by commercial banks, the volume of remote services has expanded, which directly served to improve the quality and efficiency of service.

An important aspect of the activities of modern banks is to improve business efficiency through the introduction of new technologies. One of the driving factors in the development of the digital economy is the financial sector [2]. The efficiency of service activities in banks is a comprehensive expression of the competitiveness of commercial banks, improving the efficiency of banks prevents financial risks and promotes the sustainable development of commercial banks. The efficiency of banking activities of commercial banks is

mainly focused on the efficiency of servicing customers of commercial banks.

Forecasting the efficiency of service activities in banks allows for strategic planning, evaluation of innovative digital services and overall financial stability [3].

At the same time, the importance of digital transformation of banks is manifested not only in improving efficiency and financial indicators, but also in the social indicators of commercial banks. Digital transformation of banks is based on encouraging the use of technological innovations by commercial banks. Increasing the transparency of information in commercial banks will help commercial banks improve their management system and more properly fulfill their social obligations. The use of cloud technologies to provide mobile banking, as well as banking products and services for various groups of clients can reduce the loss of resources and improve the efficiency of commercial banks. One of the important results of the digital transformation of banks is mobile banking: clients can manage wealth and acquire funds using mobile banking, which helps can improve the efficiency of commercial banks by implementing the online process. Thus, at present, the financial stability of a commercial bank is the basis for the financial stability of the entire banking system [4].

These different business models demonstrate how diverse the digital banking industry is becoming. And while each type of challenger bank tailors its services to its target customers, they all provide the same benefits.

2-table.

Benefits of digital banks for customers⁵

Easy setup	Setting up a bank account is a simple, paperless process. Most accounts can also be set up entirely from a mobile device.
Lower fees	With lower operating costs, banks can set more competitive prices for their services.
Greater financial inclusion	Branchless banks have lower operating costs and can therefore afford to accept customers who cannot obtain traditional financial services due to lack of credit history or poor credit ratings.
Focus on security	Traditional banks are known for being slow to adapt to the demand for more flexible yet secure banking services. Digital banks are not only easy to use, many are security-focused and quick to respond to the latest security threats.
Additional functions	In addition to providing digital bank accounts, many banking apps offer their customers built-in payment, budgeting, and savings tools.

The development of digital banking has changed the way individuals and legal entities manage their funds. These remote services use digital technology to provide customers with a convenient and efficient way to access and manage their accounts, conduct transactions, and interact with their banks. With digital banking, customers can perform a wide range of tasks through their smartphones, tablets, or computers, eliminating the need to visit bank branches. By providing remote services, banks can reach a wider audience, making it easier for individuals and legal entities to place their savings, as well as provide loans to entrepreneurs and manufacturers. These advanced remote services not only increase the liquidity available for loans, but also accelerate economic growth by reducing geographic restrictions and transaction barriers.

Thus, the implementation and development of digital transformation in the banking sector has had a significant impact on the increase in bank deposits, loans, and investments. The development of the banking sector and the increase in its efficiency depend entirely on the amount of funds available in a commercial bank. At the same time, individuals and legal entities have the right to choose the terms of placing their funds. A distinction is made between term deposits, i.e. providing clients with funds for a period determined by a commercial bank, and demand deposits, i.e. funds that a client can withdraw at any time.

Usually, in modern conditions, credit risk does not have a significant impact on the performance of an economic entity. All this is due to the insufficient development of the stock market, that is, the absence of credit risks and the low creditworthiness of economic entities [5]. The efficiency of the banking sector is important

⁵ Prepared by the author.

for economic development, and its assessment is a combination of various criteria, including financial, human and technological resources [6].

The prospects and profitability of introducing digital technologies into the production of goods and services can be seen in various examples of successful business development [7].

Conclusion.

It should be emphasized that the scale of development of the consumer demand factor in the field of banking product innovations in the provision of remote services is determined by the innovative technologies used by the bank. At the same time, the development of remote servicing of commercial banks requires further expansion of the capabilities of mobile payment programs.

Clients evaluate their experience with banks by how easy and convenient it was to receive a particular service, so the banking sector must constantly study the experience of communicating with clients, because new clients require the use of innovative technologies. Previously, the efficiency of banking activities was assessed by increasing the target sales volume of products and services, but in the era of digital transformation, banks are forced to consider innovative digital issues, that is, banks focus their attention on clients. In particular:

1) While previously the efficiency of banking activities was assessed by increasing the targeted sales volume of products and services, in the era of digital transformation, banks are forced to deal with innovative digital issues, that is, banks are focusing their main attention on customers.

2) By introducing innovative financial technologies, digital transformation in the banking sector can be achieved by improving the reliability of banking operations, retaining customers, and creating a customer-oriented banking system that meets the requirements of digital transformation.

3) In the banking sector, it is necessary to perfect innovative technologies, develop digital banking services, and regularly improve the qualifications of bank employees in accordance with the needs of the times.

4) When providing remote banking services, it is necessary to implement innovative types of services, taking into account the opinions of customers and their financial literacy.

In conclusion, we note that the rational use of remote services using innovative technologies in banking allows us to reduce costs, increase business efficiency, improve the quality of banking products, minimize risks and raise the level of the financial sector as a whole in the country.

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THE EMERGENCE OF FIRST FINANCIAL CRISES IN EUROPE - A BRIEF HISTORICAL RETROSPECTIVE**Mimanov M.***PhD Student**Tsenov Academy of Economics**Svishtov, Bulgaria*<https://doi.org/10.5281/zenodo.14766554>**Abstract**

Financial crises have become a frequent occurrence in recent decades, which makes us consider them as something new and modern. In fact, financial crises have a long history. In this article, we will look at some of the key crises for the American economy, which managed to cross its boundaries and have a negative impact on European economies as well.

Keywords: finance, banks, crises, USA

Unlike Europe, in the territories of the North American colonies, and subsequently the United States of America, the development of the financial sector followed the principle of "Laissez-faire" for minimal state regulation and intervention in business, and the lack of a central bank led to the emergence of the so-called "era of free banking", allowing each bank to issue its own banknotes, which freely compete with each other. It is these key prerequisites that lead to a number of financial crises in the newly created state, before the creation of the Federal Reserve. Among the more famous of them are the crises of 1819, 1832, 1857, 1893, and the Great Depression of 1929.

According to a number of researchers, the basis of the crisis of 1819 was the strong economic ties of the United States to Europe as a market for products and raw materials. The Napoleonic Wars raging on the old continent (1804-1815) contributed to the growth of the American economy and exports, especially in the field of agriculture (mainly wheat and cotton). This, in turn, caused a demand for land, the majority of which was purchased on credit by the federal authorities. (Mergelsh, 2024).

The end of the wars in Europe led to the stabilization of local economies, which, with imports from new markets (e.g. cotton from India), led to a collapse in commodity prices of more than 70%. Against the background of this worsening economic situation, in 1818 the Second Bank of the United States had to make a payment in gold to foreign investors credited with the Louisiana Purchase from France in 1803, which forced the bank to demand its loans from the state banks it financed, which in turn demanded the loans from farmers and entrepreneurs. (Lumen Learning, n.a., Rothbard, 2007).

These factors, combined with the overproduction of agricultural products in the United States, led many farmers to be unable to service their loans, which in turn led to the confiscation of mortgaged property by banks. Mass bankruptcies, in turn, led to a collapse in property prices and the inability of banks to sell the collateral for loans. Reduced consumption of industrial goods also affected manufacturers, leading to mass layoffs and mass factory closures in Philadelphia, Pennsylvania, Ohio, and Kentucky.

The first serious financial crisis caused by this free monetary competition between banks, which subsequently led to a recession of the entire economy, was the Panic of 1837 (Gibson, n.a.). After the failure of attempts to restructure the Bank of the United States as a result of President Jackson's veto in 1832, each of the 850 national banks freely printed its own money, which in the overwhelming majority was partially covered with gold and silver. (Harvard Business School, n.a.) The increased money supply resulting from the lack of centralized banking regulation initially proved to be stimulating for the economy.

In 1836, a trend began to be observed towards a reduction in the external financing of American banks and the withdrawal of English capital, which led to the decapitalization of some banks, respectively to the devaluation of the money issued by them. The real start of the Panic of 1837 was marked by the Specie Circular issued by President Jackson – an executive order requiring federal land to be purchased with precious metal coins, rather than paper currency. This act put pressure on the banks, as a significant part of their depositors tried to convert their paper money into gold or silver coins. In the following months, 343 out of 850 banks went bankrupt, 62 experienced liquidity problems, and the American economy fell into a 6-year depression. (Gibson, n.a.)

And if the crises of 1819 and 1836 were entirely national crises, although significantly influenced by international factors, the crisis of 1857 is considered the first international financial crisis to leave the confines of the American economy and affect the financial markets in Europe. What is unique about it is the speed of its spread compared to the previous ones, mainly due to the mass penetration of the telegraph as a means of communication.

In the years before the crisis, there was a serious boom in the American economy, both as a result of the new territories acquired after the Mexican War (1846-1848) and the associated increased development of railway transport and the purchase of agricultural land by new settlers, respectively, and to the strengthening of industry. The discovery of gold deposits in California awakened dreams of quick wealth and directed new flows of people to western America. The increased de-

mand for American grain crops from European countries during the Crimean War (1854-1856) further strengthened the desire for the expansion of the American economy, which was mainly financed through bank lending, including from European (mainly English and French) banks. (Grant, n.a., Kennedy, n.a.).

Although the Panic of 1857 is generally considered to have begun with the unexpected collapse of Ohio's largest bank, the Ohio Life Insurance and Trust Company (Rockoff 2000, 667), on August 24, 1857, when it unexpectedly stopped converting its notes into gold and silver, some authors attribute the bank's failure to both the excessive risk-taking by the bank's New York branch and the alleged abuses and embezzlement by its manager (Rapp, 2023).

The closure of Ohio Life caused a crash in the New York stock market, where the bank's shares, from \$101 on August 27, 1857, lost 95 percent of their value, falling to \$5 on September 2. The resulting banking panic caused New York banks to temporarily stop converting their notes into gold until October 13. The panic reached its peak in October 1857, when 1,415 banks failed and interest rates reached 60–100 percent per annum. (Kindleberger 1996, 128–129). Although the London-based Reynolds' Newspaper reported on November 15, 1857, that the panic had "spread to France," the main victim of the American crisis was the English economy, which financed numerous banking and railroad projects in the United States. (Rapp, 2023)

One of the most significant financial crises in human history was the Great Depression of 1929 in the United States, which lasted almost a decade, with industrial production falling by 47 percent in the first 4 years alone, gross domestic product by 30 percent, and unemployment exceeding 20 percent (for comparison, the Great Recession of 2007 led to a decline in GDP by 4.3 percent and an increase in unemployment to 10 percent). (History.com, 2023, Duignan, n.a.).

In the 1920s, the United States experienced impressive economic growth (known as the "Roaring '20s"), combined with the massive introduction of innovations into everyday life - cars, telephones, cinema, radio, electrical appliances, which in turn increased consumer demand, respectively. production of these goods. This development did not pass by the financial sector, with the strongest growth being recorded in the investment sector. The tangible increase in household welfare generated security and optimism in society, combined with the policy pursued by brokerage houses and investment trusts for investing with borrowed funds through margin accounts (payment of 10% of the price of shares against collateral of the remaining amount with the share itself), generated broad investment interest among the population. (Richardson, Komai, Gou, Park, 2013).

Although the American stock market lost nearly 50% in the early 1920s during the so-called "Forgotten Depression," the subsequent economic growth and high returns on stock market investments led to a kind of mania, in which people went to extremes in mortgaging homes to invest in corporate stocks. On the eve of the Great Depression, stock prices reached their highest values ever (over 19 times corporate after-tax profits),

and the Dow Jones Industrial Index (DJIA) increased by 500% in just five years. (Segal, 2024, Duignan, n.a.)

The key event that triggered the Great Depression was the stock market crash on October 24, 1929 (Black Thursday), which saw the Dow Jones Industrial Index (DJIA) fall by over 20% in less than a week (Segal, 2024). Over the next three weeks, it lost almost half of its value, and the decline continued until the summer of 1932, when the DJIA closed at 41.22, its lowest level in the twentieth century (89% of its 1929 value). (Richardson, Komai, Gou, Park, 2013)

The stock market crash also had a negative impact on the banking sector through loans granted for the acquisition of shares and non-performing loans as a result of bankruptcies. In the period 1930-1932, four large-scale banking panics were registered in the United States, and by 1933, one fifth of the existing banks failed, and the government was forced to introduce the so-called "bank holiday" as a tool to control the panic. (Segal, 2024).

As part of its efforts to contain the economic crisis, the US government intensified its protectionist policies by imposing high tariffs on a wide range of agricultural and industrial products (the Smoot-Hawley Tariff Act of 1930). In turn, the US's leading trading partners took reciprocal measures, leading to a sharp decline in US exports, a decrease in industrial production, and a 66% decline in international trade. The resulting trade imbalances and the attempts of central banks to maintain a stable national exchange rate proved to be the main transmission channel through which the economic crisis spread throughout the world. (Segal, 2024).

With the end of World War II, the world economy began its recovery, and the new financial and economic agreements from Bretton Woods (1944) played a significant role in this, which laid the foundations of the new financial architecture (Marichal, 2009). Within the framework of the agreements established, the abandonment of the gold standard and the binding of exchange rates to the US dollar were adopted, although the latter retained its fixed price of \$ 35 per troy ounce of gold (Ghizoni, 2013a, World Bank Group, n.a.). The conference laid the foundations of new international financial organizations: the International Monetary Fund and the International Bank for Reconstruction and Development (later transformed into the World Bank). The new international financial rules, including attempts to regulate national and international financial markets, significantly reduced the frequency and severity of financial crises in the economy. During this period, strong cooperation and coordination began between national central banks, as well as between creditor countries and banks such as the Bank for International Settlements (founded in 1930), the Paris Club (established in 1956), and the G-7 (1970) (Marichal, 2009).

Unfortunately, the stability achieved was relatively short-lived. The decision of US President Nixon in 1971 to end the dollar's peg to gold due to financial deficits related to the Vietnam War put an end to the so-called Bretton Woods system (Ghizoni, 2013b). This in turn triggered new waves of financial instability around the world, and in particular the debt crisis in Latin

America in the 1980s, which led to the most serious decline in the world economy since the Great Depression of 1929 (Marichal, 2009). The measures adopted to contain the crisis included debt renegotiation and restructuring, combined with radical economic restructuring of the affected economies, including the privatization of many state-owned enterprises, trade liberalization and other neoliberal reforms, and became known as the Washington Consensus. (Hurt, n.a., Irwin, Ward, 2021).)

According to some authors, it is these measures that underlie modern financial globalization, associated with the rapid expansion of international capital flows and the emergence of new financial instruments. It is precisely the rapid movement of international capital flows to and from emerging markets that subsequently turned out to be the basis of a number of financial crises: Mexico (1995), East Asia (1997), Brazil (1998), Russia (1998) and Argentina (2001) (Marichal, 2009). The high degree of integration of global financial markets, the introduction of new and increasingly risky financial instruments, combined with the trend towards deregulation of the sector, also led to the Global Financial Crisis of 2007.

Summarizing the above, we can conclude that financial crises are an integral part of human history. Depending on the development of financial markets and instruments, crises have different origins, genesis and transmission in different historical periods, but they always cause problems in the real economy and a collapse in people's living standards. The high degree of integration of international financial markets, financial innovations and deregulation are prerequisites for the rapid transmission of problems arising in one economy to the world economy as a whole.

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HISTORICAL SCIENCES

LIFE AND REIGN OF SULTAN ABDULHAMID II (1842-1918)

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Abstract

Abdulhamid II (1842–1918) was the 34th Sultan of the Ottoman Empire, ruling from 1876 to 1909. He ascended the throne during a period of decline for the empire, seeking to modernize and preserve its strength while facing internal unrest and external pressures.

Abdulhamid's reign began with the adoption of the **1876 Ottoman Constitution**, which briefly introduced a parliamentary system. However, he suspended the constitution in 1878, favoring autocratic rule, and focused on centralizing power, using censorship and an extensive secret police to maintain control. His rule is marked by significant reform efforts, including modernization of the military, infrastructure, and education.

Externally, Abdulhamid navigated a turbulent geopolitical landscape, with the empire facing military defeats, including the **Russo-Turkish War** (1877–1878) and territorial losses in the Balkans. In response to rising nationalism within the empire, he promoted **Pan-Islamism** as a unifying ideology to gain support from Muslim communities globally.

In 1908, the **Young Turks** forced Abdulhamid to reinstate the constitution and parliament, leading to the **Second Constitutional Era**. However, by 1909, a coup by the Young Turks deposed him, and he was placed under house arrest in **Çırağan Palace**, where he lived in isolation until he died in 1918.

Abdulhamid II's legacy is complex, marked by efforts to modernize the empire, but also by his authoritarian rule and controversial policies. His reign represents the final phase of the Ottoman Empire's imperial rule before its collapse after World War I.

Keywords: Abdulhamid II, Mesrutiyet I, Mesrutiyet II, Death of Abdulhamid II.

Introduction

Sultan Abdulhamid II (1842–1918) was the 34th ruler of the Ottoman Empire, who reigned from 1876 until his deposition in 1909. His life and reign were marked by efforts to preserve and modernize the weakening Ottoman state amid internal and external pressures. Ascending to the throne during a time of political instability and territorial loss, Abdulhamid faced significant challenges, including nationalist movements, military defeats, and the growing influence of European powers.

Abdulhamid initially embraced reforms and introduced the **1876 Ottoman Constitution**, seeking to modernize the empire's institutions and create a more constitutional monarchy. However, following the Russo-Turkish War (1877–1878), he suspended the constitution and ruled with increased authoritarianism. Despite his autocratic approach, Abdulhamid sought to strengthen the empire by modernizing the military, economy, and infrastructure, while also promoting **Pan-Islamism** as a unifying force across the Muslim world.

His reign, while ambitious in its efforts to reform, was also marked by repression, including violent crackdowns on ethnic and political groups, most notably the Armenians. In 1908, a revolution by the **Young Turks** forced him to restore the constitution, but by 1909, Abdulhamid was deposed in a coup and lived the remainder of his life under house arrest.

Abdulhamid II's legacy remains a subject of debate. He is viewed by some as a protector of the Ottoman Empire and an advocate for modernization, while

others criticize his authoritarian methods and the failures of his attempts to safeguard the empire's vast territories. His reign ultimately ended with the empire's collapse after World War I, and he remains a significant yet controversial figure in Ottoman and Turkish history.

Abdulhamid II (1842–1918) was the 34th Sultan of the Ottoman Empire, ruling from 1876 to 1909. His reign is often remembered for his attempts to modernize the empire and the significant political and military challenges it faced during his rule.

Early Life and Ascension to the Throne:

Abdulhamid II was born on September 21, 1842, as the son of Sultan Abdulmecid I and his consort, Gülcemal Sultan. He was educated in a manner befitting a future ruler, focusing on military and administrative matters. Abdulhamid had two older brothers, but he was ultimately chosen to succeed his uncle, Sultan Murad V, after Murad was deposed due to his mental instability. Abdulhamid ascended the throne on August 31, 1876.

Reforms and Modernization:

Abdulhamid II came to power during a time of considerable internal and external challenges for the Ottoman Empire. Early in his reign, he faced pressure from reformist groups within the empire who wanted to implement constitutional changes and modernize the state.

• **Constitutional Changes:** Abdulhamid initially accepted the 1876 Ottoman Constitution intended to establish a parliamentary system. However, he suspended the constitution and dissolved the parliament in 1878, citing the empire's unstable situation, especially due to

the Russo-Turkish War (1877–1878) and growing nationalistic movements within the empire.

- **Economic and Military Reforms:** Despite suspending the constitution, Abdulhamid sought to modernize the Ottoman military and infrastructure. He encouraged the construction of railways, particularly the Baghdad Railway, and supported the expansion of the telegraph network. He also worked to modernize the army, although his efforts were limited by the empire's financial constraints.

- **Education:** Abdulhamid placed significant emphasis on education, building many schools, including those for women, and focusing on developing a new generation of bureaucrats and military officers.

Authoritarian Rule and Surveillance:

Abdulhamid's reign was marked by an increasingly authoritarian approach. He established an extensive secret police network and used censorship to suppress opposition. The sultan maintained tight control over the empire's administration, and his government was characterized by centralization and a strong personal role in decision-making.

He was particularly concerned with the rise of nationalism among various ethnic groups within the empire, including Arabs, Armenians, and Kurds, and was particularly sensitive to the growing influence of foreign powers in the region.

Foreign Policy and the Eastern Question:

Abdulhamid II navigated a delicate balance in foreign relations, particularly as European powers sought to expand their influence in the Ottoman Empire. The "Eastern Question," referring to the geopolitical struggles over the future of the Ottoman Empire, was a constant concern.

- **The Russo-Turkish War:** The empire suffered a significant defeat to Russia in the Russo-Turkish War (1877–1878), which resulted in the loss of significant territories, including the Balkans, and led to the signing of the Treaty of Berlin (1878), which weakened Ottoman influence in southeastern Europe.

- **Pan-Islamism:** Abdulhamid attempted to use the Islamic identity of the empire as a unifying force, reaching out to Muslim communities across the world to gain support against foreign intervention. He presented himself as the protector of all Muslims and sought to rally support from Muslim-majority regions, particularly in Asia and Africa, in the face of European colonialism.

The Decline of the Empire:

By the early 20th century, the Ottoman Empire was in serious decline. The sultan's authoritarian policies, economic difficulties, and military defeats left the empire vulnerable.

- **Young Turks and the 1908 Revolution:** A movement called the Young Turks, advocating for constitutionalism and democratic reforms, gained momentum. In 1908, they forced Abdulhamid II to restore the constitution and reinstate the parliament. However, Abdulhamid's power was greatly reduced as the empire became more politically divided.

- **The 1909 Coup and Deposition:** In 1909, a military coup led by the Young Turks resulted in Abdulhamid's deposition. He was replaced by his brother,

Mehmed V. Abdulhamid was confined to house arrest until his death.

Death and Legacy:

Abdulhamid II spent the final years of his life in exile at the Çırağan Palace in Istanbul, where he died on February 10, 1918. His death marked the end of an era in Ottoman history.

His legacy is complex. Some view him as a modernizer and a defender of the Ottoman state, while others criticize his authoritarianism and the brutality of his rule, particularly in dealing with minority groups like the Armenians. Despite his efforts to reform and modernize the empire, he was ultimately unable to prevent its collapse.

Abdulhamid's reign is often seen as the last of the "traditional" Ottoman sultans, and his downfall signaled the beginning of the end for the Ottoman Empire, which would formally collapse after World War I in 1922.

I. Meşrutiyet (First Constitutional Era) refers to the period in the history of the Ottoman Empire from 1876 to 1878, during which the empire briefly adopted a constitutional monarchy. This era is marked by the introduction of the **1876 Ottoman Constitution** (Kanun-i Esasi) and the establishment of a parliamentary system. However, the reforms were short-lived, as Sultan Abdulhamid II suspended the constitution and dissolved the parliament, leading to the end of the First Constitutional Era.

Background:

In the mid-19th century, the Ottoman Empire was in a state of decline, facing increasing internal instability and external pressures. Many reformist intellectuals, military officers, and political figures were calling for a more modern and democratic system of government. They wanted to reduce the autocratic power of the sultan and establish a constitutional framework that would include a parliament and protect citizens' rights.

The **Young Ottomans**, a political group of intellectuals and reformists, were particularly influential in advocating for constitutionalism. Their push for reform was part of a broader movement to modernize the empire along Western lines and curb the centralization of power by the sultan.

The 1876 Constitution:

In 1876, Sultan Abdulhamid II, under pressure from both domestic reformists and foreign powers, reluctantly agreed to introduce a constitution. The **Kanun-i Esasi** (Ottoman Constitution) was adopted on December 23, 1876. The constitution created a parliamentary system consisting of two chambers:

1. **The Chamber of Deputies (Meclis-i Mebusan):** This lower house was made up of elected representatives from different regions of the empire.

2. **The Senate (Meclis-i Ayan):** This upper house consisted of appointed members who were chosen by the sultan. The Senate had more influence than the Chamber of Deputies.

The constitution granted civil liberties, such as freedom of speech, equality before the law, and religious freedom. It also declared that the sultan's power was limited by the constitution and the parliamentary system. This was a significant step in the direction of a

constitutional monarchy and democratic governance for the empire.

The Parliament:

On March 19, 1877, the first Ottoman parliament convened, marking a historic moment for the empire. However, the members of the parliament had little power compared to the sultan. Abdulhamid II, although having accepted the constitution, maintained absolute control over the empire and limited the role of the parliament.

II. Meşrutiyet (Second Constitutional Era) refers to the period in the history of the Ottoman Empire from 1908 to 1918, when the empire once again adopted a constitutional monarchy. This era began after the Young Turks' revolution and the restoration of the **1876 Ottoman Constitution** (Kanun-i Esasi), which had been suspended by Sultan Abdulhamid II in 1878. The Second Constitutional Era is significant for the political reforms it brought, the rise of the Young Turks, and the eventual challenges leading to the empire's collapse after World War I.

Background:

By the early 20th century, the Ottoman Empire was facing severe decline. The sultan, Abdulhamid II, had ruled authoritatively since 1876, suspending the constitution, dissolving the parliament, and consolidating power in his own hands. However, his increasingly authoritarian rule and failure to address the empire's numerous problems led to growing opposition among intellectuals, military officers, and political reformists.

The **Young Turks** were a group of reform-minded Ottoman intellectuals and military officers who advocated for constitutionalism, democracy, and modern governance. They sought to restore the constitution, limit the power of the sultan, and modernize the empire along Western lines.

The 1908 Revolution:

In 1908, the Young Turks launched a revolution, which resulted in the restoration of the **1876 Constitution** and the re-establishment of a parliamentary system. The revolution was sparked by a combination of factors, including discontent with Abdulhamid II's autocratic rule, the empire's military defeats, internal strife, economic challenges, and growing nationalist movements within its various ethnic groups.

The movement was largely led by the **Committee of Union and Progress (CUP)**, a secret political society that had been formed by Young Turks. The CUP had widespread support from the military and some civilian groups. The revolution was relatively bloodless, and on **July 24, 1908**, Abdulhamid II was forced to reinstate the constitution and call for new elections.

Key Features of II. Mesrutiyet:

1. Restoration of the 1876 Constitution: The sultan's autocratic rule was replaced with a constitutional monarchy. The Ottoman parliament was re-established, and elections were held to form a new Chamber of Deputies (Meclis-i Mebusan) and Senate (Meclis-i Ayan).

2. Rise of the Committee of Union and Progress (CUP): The CUP became the dominant political force in the empire, with significant influence over both the

government and the military. Its leaders, including **Enver Pasha**, **Talat Pasha**, and **Cemal Pasha**, took key positions in the government.

3. Political Reforms: The CUP and other reformers aimed to modernize the Ottoman Empire and centralize its government. There were efforts to modernize the military, reform the economy, and promote education. They also promoted **Turkism** as a unifying ideology for the empire's diverse population.

4. Increased Political Participation: The Second Constitutional Era saw an increase in political participation, with more open political discourse, including newspapers, political parties, and debates in the parliament. However, the political environment was often turbulent, and the CUP grew more authoritarian as it solidified its grip on power.

5. Ethnic and Religious Tensions: The empire's ethnic and religious diversity posed challenges. Nationalist movements within various ethnic groups, such as the Armenians, Arabs, and Kurds, grew in response to Ottoman policies. These tensions, along with the CUP's Turkification policies, played a role in the empire's internal divisions.

Key Events:

- **Balkan Wars (1912-1913):** The empire suffered significant territorial losses during the Balkan Wars, which involved several Balkan states that attacked the Ottoman Empire. The loss of most of the empire's European territories further weakened Ottoman power and increased nationalistic sentiment within the empire.

- **CUP's Consolidation of Power:** After the revolution, the CUP became increasingly dominant. By 1913, it had effectively taken full control of the government following a coup that ousted the liberal wing of the Young Turks. The CUP's leaders, notably Enver Pasha, took charge of the military and made key decisions regarding foreign policy and the empire's military involvement in World War I.

- **World War I (1914-1918):** The Ottoman Empire entered the war on the side of the Central Powers, hoping to recover lost territories and strengthen its position. However, the war brought further devastation to the empire. The Ottoman Empire was defeated, and the war ended with the empire's collapse.

End of II. Mesrutiyet and the Collapse of the Ottoman Empire:

The Second Constitutional Era came to an end with the defeat of the Ottoman Empire in World War I. The CUP's decision to enter the war alongside Germany and Austria-Hungary was disastrous for the empire. By 1918, after the empire's defeat, the monarchy was abolished, and the empire officially dissolved. The Republic of Turkey was established in 1923 under the leadership of **Mustafa Kemal Atatürk**, marking the end of the Ottoman system.

In summary, the **II. Meşrutiyet** represents a period of political reform and constitutional government in the Ottoman Empire, but it was also marked by internal divisions, military defeats, and the rise of a militarized and authoritarian government. Ultimately, despite its early hopes for modernization and reform, the

period ended with the collapse of the empire and the establishment of modern Turkey.

Deposed in 1909, **Sultan Abdulhamid II** was imprisoned and spent the remainder of his life under house arrest. His imprisonment marked the end of his rule and the rise of the **Young Turks** and their constitutional government.

Background and Deposition:

In 1909, a **military coup** led by the **Young Turks**, primarily the **Committee of Union and Progress (CUP)**, resulted in the forced deposition of Abdulhamid II. The coup was the culmination of growing dissatisfaction with Abdulhamid's autocratic rule, his suspension of the **1876 Ottoman Constitution**, and his failure to effectively manage the empire's many challenges, such as internal unrest and military defeats.

After being deposed, Abdulhamid II was replaced by his brother, **Mehmed V**, who had a more ceremonial role as sultan while the CUP controlled the government. Abdulhamid was initially allowed to live in the **Çırağan Palace** in Istanbul, but his freedom was severely restricted, and he was placed under close surveillance.

Imprisonment:

Abdulhamid's imprisonment took a somewhat unusual form, as he was confined in luxury, but without the ability to regain power or communicate freely with the outside world.

1. Location of Imprisonment: Abdulhamid was placed under house arrest in the **Çırağan Palace**, a grand residence along the Bosphorus. This palace, once the seat of Ottoman imperial power, became the place of Abdulhamid's exile. Despite being confined to a luxurious palace, he was isolated from political affairs and had limited contact with the outside world.

2. Surveillance: Abdulhamid II's movements were tightly controlled. The CUP kept him under constant surveillance, and he was not allowed to communicate with his supporters or engage in political activities. His isolation was meant to prevent any possibility of him regaining power or attempting a counter-coup.

3. Life in Exile: While under house arrest, Abdulhamid II's life was relatively comfortable compared to that of a typical prisoner, but he was still very much a prisoner of circumstance. He spent his time reading, reflecting, and studying various subjects, including history, politics, and religion. He remained a well-respected figure among many in the Ottoman Empire, particularly among conservative and traditional factions who viewed him as the rightful ruler.

4. Attempts at Escape: There were some reports that Abdulhamid II attempted to organize an escape or restoration of his reign, but these were unsuccessful. He was unable to regain power as the CUP maintained strict control over the empire.

Death:

Abdulhamid II remained under house arrest in Çırağan Palace for **nearly a decade** after his deposition. In the final years of his life, his health declined. On **February 10, 1918**, he died at the age of 75, possibly due to complications from a stroke. His death marked the end of an era in Ottoman history.

Legacy:

Despite his forced deposition and imprisonment, Abdulhamid II remains a significant and controversial figure in Ottoman and Turkish history. While he is criticized for his authoritarian rule, his efforts to modernize the empire and his pan-Islamic policies are also seen as important parts of his legacy. After his death, his body was buried in **Yavuz Sultan Selim Mosque** in Istanbul, and he was largely remembered as a symbol of the old Ottoman order.

Though he never regained the throne, Abdulhamid II's reign, and particularly his imprisonment, left a lasting impact on both the imperial and national consciousness of the Ottoman Empire and the early Turkish Republic.

Sultan Abdulhamid II died on **February 10, 1918**, under house arrest in the **Çırağan Palace** in Istanbul. His death marked the end of the life of the last powerful sultan of the Ottoman Empire, who had ruled from 1876 to 1909 before being deposed by the **Young Turks**.

Circumstances of His Death:

- **Illness:** Abdulhamid II's health had been deteriorating for some time, particularly in the years following his deposition. While under house arrest, he experienced a **stroke** and various health complications, which contributed to his physical decline.

- **Final Years:** Although living under strict surveillance and in relative isolation, Abdulhamid spent his final years largely in contemplation, reading, and reflecting. Despite his exile, he still maintained a significant following and was seen by many as the legitimate sultan, and he remained a respected figure in the eyes of those loyal to the old Ottoman system.

The Aftermath:

- **Funeral:** Upon his death, Abdulhamid's body was buried in the **Yavuz Sultan Selim Mosque** in Istanbul. His funeral was a modest affair, reflecting both his status as a former ruler and the circumstances of his later life in exile.

- **Legacy:** Sultan Abdulhamid II's death marked the final end of the era of the absolute monarchs of the Ottoman Empire. The empire itself was in a state of disarray by 1918, having been weakened by internal strife, military defeats, and the ongoing challenges of World War I. The **Ottoman Empire** would collapse three years later, after the war, and the **Republic of Turkey** would be founded in 1923 under the leadership of **Mustafa Kemal Atatürk**.

In Conclusion.

Sultan **Abdulhamid II**'s reign, though marked by significant reforms and authoritarian control, stands as a pivotal period in the history of the Ottoman Empire. His efforts to modernize the military, infrastructure, and education were notable, but his repressive tactics, including censorship and the suppression of nationalist movements, contributed to internal unrest. Despite briefly restoring the **1876 Ottoman Constitution** in 1908, his eventual deposition by the **Young Turks** in 1909 signaled the end of his rule and the beginning of a new political era for the empire. Abdulhamid's legacy is complex—while he is remembered for his determination to preserve the empire and his advocacy of **Pan-**

Islamism, his failure to adapt fully to modern political currents, coupled with his authoritarian rule, hastened the decline of the Ottoman state. His death in 1918 marked the final chapter of Ottoman imperial rule, just a few years before the empire's formal collapse after World War I, and the rise of the **Republic of Turkey** under Mustafa Kemal Atatürk.

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JURISPRUDENCE

LEGISLATION OF THE KAZAKH ASSR ON RESTRICTION AND VALIDITY OF CUSTOMARY LEGAL NORMS AND INSTITUTIONS

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Abstract

The article examines the main stages of the peculiarities of the functioning of customary law in the conditions of the Kazakh Autonomous Soviet Socialist Republic. The violent breakdown of the customary legal method of regulating social relations was not only the result of the tragic events of the early 30s that occurred in Kazakh society, but also one of the objective reasons underlying this tragedy. The legislative policy of state bodies, which determines the limits, spheres and forms of action of customary legal institutions under the conditions of Soviet power, is analyzed.

Keywords: Kazakh Autonomous, legislation, customary law of Kazakhs, Kazakh society, Soviet power, Judicial branch, functioning of customary law, legal policy, customary institutions, customary law.

On the eve of the October Revolution, one of the main sources of current law in Kazakhstan remained unwritten norms of adat. Despite the active penetration of the principles and norms of imperial legislation and the system of Islamic law (Sharia), the customary legal system in its inherent basic structure was not destroyed, although it underwent huge normative and functional-content shifts. Even if there were noticeable changes in the correlation of norms of different systems of law operating in the Kazakh steppe, the dominant position among the means of legal regulation remained for customary legal norms. This is due to the fact that the changes least of all affected the social and economic foundations of society. The existing social relations remained dominant and determining in the structure of Kazakh society up to the beginning of the XX century. True, they did not remain absolutely unchanged, but there were no fundamental, qualitative, revolutionary transformations in this sphere in that period. The prestige and power of customary legal norms were still significant in the early 20th century, especially in the sphere of family and marriage, economic and property relations within nomadic and semi-nomadic societies. However, by that time the position of criminal customary norms had somewhat weakened, due to the active attack on them by the local Russian authorities, whose interests were directly affected by them. The main institutions of adat in the sphere of family and marriage relations were kalym, polygamy, amengerstvo, and criminal customary-kun. The customary legal norms and institutions, which had been formed and were in force for centuries, had a significant social force in Kazakhstan after the establishment of Soviet power. Customary law had a strong system of norms (customs, morals, traditions), which, it seemed, could not be broken by any social transformations. As if grown into the social and economic way of life of the society, organically merged with the forms of everyday life, social

psychology, system of customs, the traditional customary legal culture tested by centuries opposed the legislative and normative one.

From the first days, the Soviet authorities declared respect and attention to the customs, traditions and beliefs of peoples, including customary legal norms and institutions. In the address of the Soviet government of 20 November 1917 "To all working Muslims of Russia and the East" it was stated "Henceforth your beliefs and customs, your national and cultural institutions are declared free and inviolable." [1,114]

In legislative acts and documents, customary law norms were regarded as an integral part of the normative culture of the people, the system of their customs, traditions and beliefs. Accordingly, the Soviet state pursued a cautious legal policy with regard to customary law, allowing in certain cases elements of cooperation, integration, and reinterpretation of customs; measures were taken to collect, systematize and codify the norms of customary law; and the dualism of legal systems and judicial institutions. The prospective goals and interests of the state of the dictatorship of the proletariat allowed for the possibility of the preservation and joint existence of customary and legislative ways of regulating social relations in socialist society, provided that the norms of Soviet laws had priority. Customary-legal regulations could operate under the control of the law-making laws of the Soviet state within the framework and limits of the basic principles of the socialist legal superstructure. Such an approach to customary legal institutions was due to the fact that the main aim of proletarian power in the Krai was to overcome the class character of social relations. The replacement of the legal institutions of the old society with new socialist ones in the conditions of Kazakhstan extended only to that part of the norms of customary law which was incompatible with the laws of Soviet power and to the extent and within the limits in which

it was necessary to overcome this incompatibility. The realization of this task was to take place gradually, and from the very beginning was regarded as a complex and contradictory process of struggle between the old and the new, the progressive and the harmful, designed for a rather long period of time. Such a tolerant and attentive attitude to legal customs during the implementation of transformative actions (concerning various spheres of social relations in the Krai, regulated by the norms of customary law), at that time, did not mean the refusal to fight against the norms of adat contradicting the principles of the new system. But the main attention of the legislator was directed to the transformation of the socio-economic character and the adoption of positive laws consolidating the social relations that had arisen. A new regulator of social relations (as opposed to the one based on customs) was created, and the conditions for its functioning were formed. The customary-legal way of regulating social relations had to be preserved and continue to function to the extent that it did not interfere with the policy of establishing and establishing a unified socialist legality in the country. And this meant inevitable qualitative changes, deep structural transformations. The Soviet authorities paid the greatest attention to customary law in the first ten years of its existence. In these years, customs and traditions, customary legal norms were constantly taken into account in the activities of the party, state authorities, administration and courts. Later on, the Soviet authorities gradually lost interest in the problem of customary legal culture, reducing it to the fight against the so-called relic norms of adat.

The process and course of action of customary law in the conditions of the KazASSR in the literature is conditionally divided into three stages [2,26].

Chronologically, it looks as follows:

- 1) from the establishment of Soviet power in Kazakhstan to the formation of the KazASSR;
- 2) from the moment of KazASSR formation to the end of the restoration period (1920-1925);
- 3) The third stage of 1925 until the application of customary law norms in judicial practice is completely excluded and they become customs that are not authorized by the State.

At the first stage, the Soviet state officially recognizes customary law as one of the sources of law in Kazakh society and preserves the principles that determine the limits and scope of its influence, the nature of interaction of its norms with the laws of Soviet power.

Thus, the norms of customary law were to be valid in the krai and accepted for guidance insofar as they did not contradict the socialist foundations of law and Soviet legislation. This was the basic principle that was to determine the activity of the authorities of the krai in applying the norms of customary law, as well as in harmonizing them with Soviet legal provisions. For the first time, general guidelines in this regard were formulated in the Decree on the Court No. 1 of 22 November (5 December) 1917. "Local courts," said paragraph 5 of the decree, "decide cases in the name of the Russian Republic and are guided in their decisions and verdicts by the laws of the overthrown governments only insofar as they have not been abolished by the revolution and

do not contradict the revolutionary conscience and revolutionary legal consciousness" [3,25].

Applied to the conditions of Soviet Kazakhstan, this general legal attitude was interpreted in the article of the decree of the SNK RSFSR "On the Revolutionary Committee for the Management of the Kirghiz (Kazakh) Territory" of 10 July, which stated: "The purpose of the Revolutionary Committee is: ...to implement all the decrees of the Central Soviet power in accordance with the life, customs and conditions of the local population... Cases between the Kyrgyz are resolved by the people's court on the merits of the case according to customary law" [4,129].

The legalised nature of the norms of customary law has left its mark on all the activities of the party, state and other bodies in the region, in particular, in the conduct of party-political and social activities. In the context of the Kazakhstan of that period, attention was paid to ensuring that the cadre of local bodies consisted of persons well versed in the customary legal life of the Kazakhs. Particular attention was paid to the fact that the cadre of local bodies consisted of persons who were well versed in the customary legal life of Kazakhs. In a letter dated

7 May 1919 to the All-Russian Bureau of Political Commissars, the regional bodies demanded the early approval of the second military commissar of the Turgai province, Comrade II. V. Tokarev, as he "perfectly knows the Kyrgyz (Kazakh-Z.K.) language and customs of this people.." [5,143-144].

In the legislative activity of the State of the dictatorship of the proletariat, the consideration of customary law found its manifestation in the fact that it was legalized to the extent that it did not contradict Soviet laws and was recognized as a valid source of law in parallel with them. In this connection, the regional bodies of Kazakhstan have taken measures aimed at collecting, systematizing and codifying norms of customary law. Thus, one of the main tasks of the Kazakh Department of the People's Commissariat of the RSFSR, established on 1 May 1918, was "to draft civil and criminal laws accordingly with the customary law of the Kirghiz (Kazakhs), putting the idea of socialism in the basis" [6,82].

The existence of customary law along with the laws of the Soviet government affected the activities of administrative bodies and other authorities vested with administrative powers in Kazakhstan. They had to be particularly careful and attentive

when dealing with issues concerning the interests and needs of the population, while maintaining a strictly loyal attitude to their rites and customs. The practice shows that these bodies and their representatives on the ground mainly tried to keep "neutrality" and not to interfere (except for emergency cases, appeals of the population) in those areas and spheres of relations that were regulated by centuries-old customs.

In the exercise of judicial power, the legalized nature of the existence of the customary law method of regulating social relations in Kazakhstan was expressed in the direct use and application of adat norms in the resolution of civil and criminal cases. The peculiarity of the action of norms and institutes of customary law in the legal practice of the region in the first years was that they were applied both by the Soviet authorities

and its judicial and investigative apparatus, and by the biys and arbitration courts that existed in this period. The harmonization of the norms of customary law with the socialist acts of Soviet power was carried out in the course of direct practical activity of local judicial and investigative bodies in solving specific cases and disputes. And the main and only way to resolve and remove existing contradictions was to harmonize them in each specific case (court case, disputes) by making an individual decision of an authoritative nature by an authorised body or person.

All these documents once again show that the attitude of the organs of the dictatorship of the proletariat to customs and traditions in this period was determined first of all by and subordinate to the task of imposing and strengthening Soviet power in the localities. A tolerant and loyal attitude to the traditional norms of the population did not express a principled position of the Soviet power, but was only a means, a "temporary tactical move" for the achievement of the above-mentioned goal, after the fulfillment of which it was replaced by other measures corresponding to the next urgent slogans of the Bolshevik Party. Customs and traditions were not regarded as values in themselves, but as potential social objects of state influence in need of change and transformation.

The second stage of the functioning of customary law in the region lasts from the moment of formation of the Kazakh ASSR to the end of the restoration period (1920 -1925). At this time, the issues of attitude to customary law mainly begin to be considered and solved by the higher and local authorities of the young Kazakh Republic. They were guided by the already adopted decisions of the Centre and proceeded from the needs and realities of local life. Based on the continuity in their activities, the supreme bodies of power and administration of the KASSR preserved and repeatedly confirmed the legalized nature of the norms and institutions of customary law, which did not contradict the principles and laws of Soviet power.

During this period, as before, the customary law method of social regulation was taken into account in the activities of party, state and other institutions of the region. The Constituent Congress of Soviets of the Republic set before the NKJ as one of the tasks "collection and systematization of materials of customary law of the Kyrgyz (Kazakh) people for practical legislation" [8,34].

The All-Kazakh Congress of Soviets, the CEC and the SNC of the KazASSR not only authorized adat provisions, allowing their parallel existence along with their own legal provisions, were engaged in their codification, but also undertook other measures aimed at the fullest consideration and use of customary law. Indicative in this regard is the adoption of the decree "On dowry, jasau and marriage gifts" [9]. The purpose of this decree, approved by the Council of People's Commissars of the KazASSR on 29.09.1921, was to protect progressive folk traditions and customs in the sphere of family and marriage from administrative interference of local authorities and administration. At the same time, the legislator aimed to familiarize the employees of the regional state apparatus with the purpose, content and existence of these customs and characterized them.

Thus, jasau and liyu, according to the decree, are "property (in money, things or livestock) given by par-

ents or relatives of the bride on the occasion of her marriage..." [9,99]. According to the meaning of the law, jasau and liyu consists of two parts. The first part - dowry - is "a gift, which the bride on the occasion of her marriage receives personally for herself from her parents or relatives - in money, livestock, clothes and various household items" [9,100]. It was recognized as property forming an integral part of the bride's property. The other part of the jasau and liyu, which did not constitute the bride's personal dowry, was "irrevocably owned by the persons who received this property, even if the marriage was later dissolved by divorce of the spouses" [9,101]. The decree also recalled the existence in Kazakh society of non-refundable gifts and offerings exchanged between the bride and groom on the occasion of marriage.

At the second stage of the functioning of customary law, the decisions of the Constituent Congress of Soviets of Kazakhstan played a certain role in determining a new legal policy in relation to the norms and institutions of adat, recognized as contradicting Soviet laws. The Congress made it clear that kun and kalym were deprived of judicial protection, condemned polygamy and amengerism, and recognized barimta as a crime. The norms and institutions of customary law, recognized as contradicting Soviet laws, were condemned in their entirety and in all their manifestations. The significance of the congress's guidelines was that they reflected the policy of the new authorities and the overdue opportunities in this direction. Although the abolition of these adat norms did not mean changes in the existing judicial and investigative practice aimed at limiting their effect. The judiciary still had to take into account the power and influence of the institutions of kun, kalym, amengerism and polygamy when deciding cases. The practical implementation of these congress decisions required the drafting and adoption of special bills that would regulate in detail the activities of law enforcement agencies in connection with the transition to more decisive measures to combat the adat system.

During this period, various methods and measures were being prepared and tested in order to develop the most optimal ways and means of combating the recognized harmful norms of adat. The latter was formalized and established as a state-organised struggle against remnant relations in the Krai. The latter was formalized and established as a state-organised struggle against remnant relations in the Krai. Such measures as the abolition of adat institutions (decree on the abolition of kun, kalym on the punish ability of polygamy and amengerism), abolition of customary legal institutions of adat (court of biys, "aksakal courts"), establishment of criminal punishment for certain vestiges representing social danger (barymta, etc.), official non-recognition of some customary legal norms (clan oath, religious oath) were widely practiced. In other words, a number of norms of customary law institutions are legally prohibited from being legal as they are recognized as incompatible with the socialist principles and laws of the Soviet government. The point is that in the conditions of Kazakh society, the struggle against the above-mentioned institutions of adat could not be immediately organized, since there were not yet objective conditions for a decisive struggle against them. This is also evidenced by the fact that the question of methods and forms of struggle against the recognized harmful customary-legal establishments had not yet been finally

resolved. Thus, kalym, kun and baryta were proposed to be and were being fought with criminal law, while polygamy was initially limited to a simple legislative (verbal) prohibition and only later supplemented with criminal law punishment. Similarly, with regard to the courts of biys and aksakal courts, at first they limited themselves to their organisational dissolution, later they were going to fight them mainly with civil law measures (partially introducing criminal law liability), but later, considering half-hearted and insufficiently effective what they had done, they began to focus on the criminal law type of struggle. The criminal-legal struggle against manifestations of adat was introduced (1920), then suspended by the central organs of the Federation (1922), and then reintroduced (2 years later at the end of 1924). It became organized and legally formalised in late 1924-early 1925.

All these measures, accompanied by the adoption of various normative acts sanctioned by the supreme bodies of state power of the Republic and the Russian Federation, had as their common consequence that in 1920-1925 it was only possible to achieve the abolition and supplanting of legal forms of existence and the official open nature of the existence of the abolished customary legal institutions. They went into the "underground" and existed in hidden and veiled forms. It is characteristic that while at first the measures taken to overcome the norms of adat were of a local, regional nature, later they were recognized and approved at the federal and all-union level, thereby acquiring nationwide significance and force.

The next (third) stage covers the period from 1925 until the moment when the application of customary law norms in judicial practice is completely excluded and they become customs that are not authorized by the state.

In the legislative acts of the Republic of this period they are no longer mentioned as one of the sources. At the same time, the issue of customary law remained as if "open", the application of its norms was not officially prohibited and the possibility of their use was not completely excluded. This was a period of "tacit" recognition of customary law as an "unofficial", "reserve" source, some norms of which could be allowed into the sphere of the official normative superstructure in particularly limited limits, under strict control, to solve cases related to the need to take into account the level of legal consciousness and legal psychology of the masses.

Such a need was observed, in particular, in solving cases related to barimta during the period when it became widespread. In setting up government commissions to resolve such conflicts, the supreme authorities emphasized that mutual quarrels should be resolved through peaceful agreements, which was usually achieved by invoking and referring to existing customs, legal views and attitudes.

The action of some norms of customary law during this period in Kazakhstan, its occasional "break-throughs" into the normative sphere of the official legal superstructure of the region were explained by the fact that it still had force and retained its position in the sphere of legal psychology and legal consciousness of

the indigenous population.

In the time period under consideration, under the conditions of the orientation of party-state power in the country towards command-administrative methods of management and the strengthening of unitary tendencies in the sphere of nation-building, the main thing in the activities of local authorities in relation to customary law is the fight against its abolished and recognized harmful provisions. Becoming a priority and striking, the task of combating these norms of adat completely absorbs not only the problem of using customary legal norms, but also the problem of taking into account the legal psychology and legal consciousness of the masses, reflecting the specificity of national consciousness and national psychology.

The end of the third stage of the existence of norms and institutions of customary law in Kazakhstan falls on the years of continuous settlement and collectivisation of nomads and semi-nomads. In these years, the customary legal method of regulating social relations in the region was subjected to violent breakage. The violent breakdown of the customary-legal method of regulating social relations was not only the result of the tragic events of the early 1930s that took place in Kazakh society, but also one of the objective reasons underlying this tragedy.

The results of the violent breaking of the customary-legal way of regulating social relations are very contradictory and tragic. On the one hand, it seemed that radical changes were made in the life and consciousness of people, patriarchal attitudes and norms were overcome. At the same time, the masses did not accept and master the new legal system. The proposed legal reality, as before, was not clear, imposed from above. The masses have not only lost their former legal understanding and legal reality, but have not lost their new legal understanding and have not mastered the new legal situation.

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MEDICAL SCIENCES

PROFESSIONAL ORAL HYGIENE IN THE PRESENCE OF IMPLANT-SUPPORTED STRUCTURES

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Abstract

Currently, an important goal in dentistry is to restore the aesthetic and functional contour of the dentition, the comfort of diction and the health of the patient. To solve such problems, dentists are increasingly using orthopedic structures supported by implants. Every year the number of installed dental implants increases. The global market shows a doubling of sales from \$3.4 billion in 2011 to \$6.6 billion in 2018. Compared to other edentulous treatment methods, the popularity of implant treatment is 70%, bridges and crowns 12%, and removable dentures 10%.

Keywords: dentures on implants, bridges, removable dentures, oral hygiene.

The success of implant survival depends not only on the correct implantation procedure and orthopedic treatment, but also on the motivation of the patient himself in caring for the implants[1]. Oral hygiene remains the most important aspect of implant survival. The area of dental implants is most sensitive to dental plaque microorganisms, which most often form on the crowns and cervical surface of both implant superstructures and the implants themselves. Excessive accumulation of pathogenic microflora leads to significant inflammation in the peri-implant tissues[2]. Therefore, each patient needs both individual and professional oral hygiene. Removing dental plaque from the surface of the abutment itself has its own characteristics, dictated by the properties of titanium. It is known that titanium and its alloys are surface-sensitive metals in which individual defects sharply reduce the performance of the material [3]. The group of instruments that damage the surface layer of titanium includes nylon brushes, Air-Flow using sodium bicarbonate powder, steel ultrasonic cures, scalers (which cause macro damage). Defects in the form of microcracks, scratches and pores contain iron oxide, which sharply worsens the bioinert properties of the material. Also, due to the resulting defects, the adhesion of microorganisms to the rough surface of the implant increases, which increases the likelihood of peri-implantitis and perimucositis[4]. Accordingly, the surface remains most homogeneous when processed with plastic tools: implacers, Teflon nozzles.

The purpose of the study is to determine the effectiveness of acceptable professional hygiene methods for implants and to increase the level of preventive measures in patients with implants.

Material and methods.

9 patients with dental implants took part in the study. 3 different methods of professional hygiene were chosen: 1) rubber caps; 2) ultrasonic tips PI (EMS) with plastic coating; 3) Perio-Flow technology - air-abrasive supra- and subgingival treatment using Air-Flow Perio (EMS) glycine-based powder with a particle size of 25

microns. As a result, patients were divided into groups according to the chosen cleaning methods. Before carrying out professional hygiene, additional studies were carried out to determine hygiene indices, to assess the condition of soft tissues in the implant area and the presence of hard deposits on implants and superstructures after 5, 15, 30 days. A modified implant hygiene index was used. This index is based on the simplified Green-Vermillion index; Gingival Index (gingival index) - Loe & Silness. After cleaning, irrigation was carried out with an antiseptic (0.05% chlorhexidine solution, 3% hydrogen peroxide solution). Each patient was given recommendations for individual hygiene on implants. For the reliability of the study, microbiological analysis of dental plaque was also used before professional hygiene, after 5, 15 and 30 days. Dental plaque was stained using Gram staining and microscopied. Results and discussion. The examination before carrying out professional hygiene showed high values of the IGIM index - the average value in all groups was 0.8 (a sufficient indicator of hygiene), when determining the GI index, the average value for the groups was 0.9 (mild gingivitis), upon probing there was slight bleeding and hyperemia. During the study, in group 1, in which manual methods of professional hygiene were used, the indices changed with different dynamics, so in 5 days the IGIM indicator was 0.5, and GI was 0.7. Then, after 15 days, the dynamics of changes began to reverse, the IGIM index increased - 0.7, and GI - 0.8. By 30 days, IGIM and GI returned to their original values. In group 2, using an ultrasonic attachment, on the 5th day the value of IGIM = 0.3 and GI = 0.5. On the 15th day, the indices remained virtually unchanged; when checked on the 30th day, the indices increased by 0.1. In group 3, using Air-Flow and glycine powder, the modified OHI-S index changed to 0.4 after 5 days, and the gingival index was equal to 0.5. After 15 days, the indices increased by 0.1. On the 30th day, the indices were 0.65 and 0.71, respectively. The conducted stud-

ies show the most effective method of professional hygiene of implants from the point of view of index assessment. According to the results of microbiological analysis in the field of view, the largest number of microorganisms is observed in group 1, in which only mechanical cleaning was carried out; The best result was achieved by the 2nd group, in which ultrasonic cleaning was used. Compared to plaque on natural teeth, fusobacteria, individual diplococci and vilonella are more common in plaque from the area of implants.

Conclusion.

The area of dental implants is most sensitive to plaque microorganisms, which increases the need for more frequent professional hygiene. The most effective professional hygiene method for patients with implants is ultrasonic treatment with Teflon tips. Only mechanical cleaning of the surfaces of implants and superstructures does not provide a long-term positive effect. Perio Flow technology showed intermediate results, which

indicates an insufficient sanitizing effect. Microbiological studies and hygiene tests allow you to objectively assess the patient's hygienic condition throughout the entire observation period

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DEFINITION OF ANTIMICROBIAL ACTIVITY OF ESSENTIAL OIL OF SATUREJA HORTENSIS AGAINST DOMINANT OPPORTUNISTIC PATHOGENIC BACTERIA ISOLATED FROM PATIENTS WITH ACUTE RESPIRATORY INFECTIONS

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Abstract

Antimicrobial Activity of *Satureja hortensis* Essential Oil Against Dominant Opportunistic Pathogenic Bacteria Isolated From Patients With Acute Respiratory Infections

The essential oil of *Satureja hortensis*, derived from wild populations in Azerbaijan, represents a significant source of antimicrobial compounds. This study evaluates its antibacterial activity against opportunistic pathogens causing acute respiratory infections (ARIs). Essential oil was extracted through steam distillation, and its chemical composition was analyzed using gas chromatography-mass spectrometry (GC-MS). Antimicrobial activity was assessed using the disk diffusion method against standard bacterial strains (*Staphylococcus aureus* ATCC 29213, *Escherichia coli* ATCC 35218, *Klebsiella pneumoniae* ATCC 700603, and *Pseudomonas aeruginosa* ATCC 27853) and clinical isolates from sputum samples of ARI patients.

The essential oil demonstrated notable antibacterial properties, with varying inhibitory effects depending on the bacterial species. The strongest inhibition was observed against clinical isolates of *S. aureus*, *E. coli*, and *K. pneumoniae*, while *P. aeruginosa* exhibited the lowest sensitivity. GC-MS analysis revealed that thymol (37.61%), γ -terpinene (21.47%), and p-cymene (12.31%) were the primary components, distinguishing the Azerbaijani variety of *Satureja hortensis* from others.

These findings show the potential of *Satureja hortensis* essential oil as a natural antimicrobial agent. Its high efficacy against opportunistic pathogens suggests its suitability for developing treatments for ARIs, offering an alternative to synthetic antibiotics in combating antibiotic resistance.

Keywords: acute respiratory infections, antimicrobial activity, *Satureja hortensis*, essential oil, disk diffusion method, thymol, GC-MS.

The essential oil of *Satureja hortensis*, derived from wild-growing populations of garden savory in Azerbaijan, is an important source of antimicrobial substances. The aim of the study was to assess the antibacterial activity of the essential oil of *Satureja hortensis* against opportunistic pathogenic bacteria – causative agents of acute respiratory infections. The essential oil was obtained by steam distillation. The component composition of the studied essential oil was analyzed by gas chromatography-mass spectrometry using an Agilent Technologies 6890 chromatograph. Antimicrobial activity was determined by the disk-diffusion method. The experimental strains used were standard cultures of *Staphylococcus aureus* ATCC 29213, *Escherichia coli* ATCC 35218, *Klebsiella pneumoniae* ATCC 700603, *Pseudomonas aeruginosa* ATCC, and 9 clinical bacterial strains: *Klebsiella pneumoniae* (3), *Pseudomonas aeruginosa* (3), *Staphylococcus aureus* (2), *E. coli* (1) isolated from patients with acute respiratory infections (ARI). It was found that the essential oil demonstrated excellent antibacterial properties

against both reference and clinical strains, with the intensity of the effect varying slightly depending on the bacterial species. The highest inhibitory effect of the essential oil of *Satureja hortensis* was observed for clinical strains of *S. aureus*, *E. coli*, and *K. pneumoniae*, while the least effect was observed for *P. aeruginosa* strains.

Keywords: acute respiratory infections, antimicrobial activity, essential oil of *Satureja hortensis*, component composition, disk-diffusion method.

In the modern world, the high frequency of acute respiratory infections (ARI) among both children and adults is due to increased susceptibility to potential respiratory pathogens, which determines the medical importance of this issue and its social significance [1,2]. Etiologically significant pathogens of ARI are bacteria and viruses that cause similar clinical symptoms, due to the tropism of the infectious agent to the epithelial cells of the respiratory tract [3]. Drug therapy for ARI includes antimicrobial agents, immunomodulatory drugs, and vaccines against the main pathogens of bronchopulmonary infections [4,5]. Most antibacterial

drugs can cause various side effects with prolonged use, which limits their application in the treatment of respiratory infections. Furthermore, the increasing resistance of respiratory infection agents to synthetic chemotherapeutic drugs forces researchers to find new, more effective, and environmentally safe methods for the treatment and prevention of ARI [6,7,8].

In recent years, the rise of antibiotic resistance in microorganisms has led researchers to focus more on natural compounds with various biological effects (like antibacterial, antiseptic, and immune-boosting properties). One such group is plant-based essential oils, which show different levels of antimicrobial activity depending on their chemical makeup [9]. The long history of our ancestors and recent progress in pharmacognosy create new opportunities to use essential oils in making antimicrobial drugs for preventing and treating various diseases, including infections [10,11].

Studies by many researchers, both local and international, have shown that essential oils from mint, tea tree, savory, clove, and eucalyptus have antimicrobial properties against many harmful microorganisms, including some viruses. This effect is due to compounds like carvacrol, thymol, terpinen-4-ol, and various flavonoids, making them an interesting topic for pharmacological research [12,13,14,15].

Azerbaijan has a strong tradition of folk medicine, where healers have used medicinal plants for centuries, thanks to the country's rich and diverse plant life. Special attention is given to plants that have been used in traditional medicine for many years [16]. One such plant in Azerbaijan is *Satureja hortensis* (garden savory), which belongs to the mint family (Lamiaceae). This plant is important in pharmacology, cosmetology, and medicine due to its high content of valuable components [17]. In medicine, it is used as an expectorant, antibacterial, diuretic, and antifungal treatment [18,19]. In Azerbaijan, *Satureja hortensis*, known as "ət otu," is also used as a seasoning in cooking, especially for meat.

So far, a lot of research has been done on the active compounds, like terpenoids, found in the essential oil of *Satureja hortensis*. These compounds play an important role in the plant's life and are also a valuable source of natural antioxidants and biologically active substances [20,21,22]. *Satureja hortensis* (L.) is a small shrub that grows up to 50 cm tall, with small, leathery, lance-shaped leaves that have tiny glands on the upper side. It grows naturally in the Shakhbuz district of the Nakhchivan Autonomous Republic, on dry, rocky slopes (39°21'44.27" E; 45°40'18.07" N, altitude 1592 m). The soil there is loamy, well-drained, and rich in potassium and phosphorus, with a pH of 6.5 to 7.0. The unique climate and geography of Azerbaijan help create a special chemical composition in the essential oil, which has high levels of thymol and carvacrol, known for their antibacterial effects [23,24]. This makes studying the antimicrobial properties of *Satureja hortensis* essential oil especially important.

The aim of this study was to test the antibacterial activity of *Satureja hortensis* essential oil against common pathogenic bacteria found in sputum samples from patients with respiratory infections. The objectives in-

cluded extracting and analyzing the chemical composition of the essential oil, and isolating bacterial strains from clinical sputum samples to test the oil's antimicrobial effects on both reference and clinical bacterial strains.

Materials and Methods

For this study, the leaves of *Satureja hortensis* were used. The harvest was collected in July-August 2023 during the mass flowering of *Satureja hortensis* to minimize the loss of essential oil. The plant material was dried by air drying to avoid the destruction of biologically active substances and to remove excess moisture. The drying process was carried out in a shaded area at a temperature of 25-30°C for 5-7 days. The dried plant material was then ground in a laboratory mill to particles passing through a sieve with 2 mm holes. The essential oil was extracted using the steam distillation method. The ground plant material was placed in a 1000 ml round-bottom flask, 300 ml of purified water was added, and the flask was sealed with a rubber stopper. The flask with the contents was heated on a flask heater and boiled for two hours. After distillation (6-8 hours) and cooling to room temperature, the volume of the essential oil was measured and collected in a sterile test tube. The samples of essential oil were dissolved in hexane at a 1:300 ratio.

The composition and individual compounds of the essential oil were analyzed using gas chromatography-mass spectrometry (GC-MS) on an Agilent Technologies 6890 chromatograph with a mass spectrometer. The analysis was done using a DB-5ms capillary column (0.25 mm diameter, 0.25 µm stationary phase thickness, 30 m length) under the following conditions: the temperature started at 60°C for 3 minutes, then increased to 250°C at a rate of 15°C per minute, and was held at 250°C for 3 minutes. Helium gas was used at a flow rate of 1 ml/min, with a 1:100 separation factor. The mass spectrometry analysis was done with a 3-minute retention time, 50 mA emission, and a scan range of 30-350 amu, scanning at 1600 amu/s. The ion source temperature was set to 230°C, the transfer temperature to 280°C, and the analysis lasted 21 minutes. Compounds were identified by comparing their mass spectra with reference libraries (NIST 2011 and Wiley 2010), and a compound was considered identified if the match was over 85%.

Clinical bacterial strains were collected from sputum samples of 302 patients with acute respiratory infections (ARI) at the "Referans" Clinical Laboratory in Baku. The samples were cultured on solid nutrient media like blood agar, Endo medium, egg-salt agar, and meat-peptone agar. Bacterial identification was done using the automated VITEK 2 system. Among the pathogens isolated, the most common were *Klebsiella pneumonia* (53 strains), *Pseudomonas aeruginosa* (38 strains), *Staphylococcus aureus* (20 strains), and *Escherichia coli* (9 strains).

The antibacterial activity of the essential oil was determined by the disk-diffusion method, as described in guidelines for determining the sensitivity of microorganisms to antimicrobial agents [25]. The method is based on the visual detection of inhibition zones. The

test cultures used were reference strains (*Staphylococcus aureus* ATCC 29213, *Escherichia coli* ATCC 35218, *Klebsiella pneumoniae* ATCC 700603, *Pseudomonas aeruginosa* ATCC 27853) from the bacterial culture collection of the Department of Medical Microbiology and Immunology, Azerbaijan Medical University. Nine clinical isolates were also used, corresponding to *Klebsiella pneumonia* (3), *Pseudomonas aeruginosa* (3), *Staphylococcus aureus* (2), and *E. coli* (1), isolated from sputum samples of patients with various respiratory tract pathologies. Suspensions of the bacterial cultures were prepared in sterile physiological saline, achieving a final concentration of 1.5×10^8 CFU/ml (0.5 on the McFarland standard). For microbial load control, a measured inoculum was plated onto Mueller-Hinton agar. A bacterial lawn was obtained by inoculating 1 ml of the inoculum onto a Petri dish, where the suspension was spread with a sterile swab over the Mueller-Hinton agar surface. After 20 minutes of absorption, a paper disk (6 mm in diameter) adsorbed with *Satureja hortensis* essential oil was placed on the surface. The results were evaluated after 18–24 hours of incubation at 37°C. The antibacterial activity was assessed by measuring the diameter of the growth inhibition zone: very high sensitivity (22 mm and above), moderate (15–21 mm), and weak (14 mm and below).

Results and Discussion

The content of essential oil in the plant material was 2.6%. The isolated essential oil was an oily liquid of light-yellow color with a pungent, spicy taste and a characteristic smell.

Gas chromatography-mass spectrometry analysis of the essential oil of *Satureja hortensis* obtained from air-dried plant material identified at least 32 compounds, with the largest mass fractions being thymol (37.61%), γ -terpinene (21.47

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PSEUDOALLERGY: ETIOLOGY, PATHOGENESIS AND MODERN METHODS OF PHARMACOTHERAPY

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Abstract

In the modern world, allergies rank among the most common adverse reactions to medications and food products. However, certain reactions occur without the formation of antibodies, yet they present with similar clinical symptoms. This phenomenon is known as "pseudoallergy" or non-allergic anaphylaxis. Like true allergies, pseudoallergies involve various subtypes and activation mechanisms. Regardless of the underlying pathway, these reactions ultimately result in the release of mediators, particularly histamine. This article examines the pathomechanisms of pseudoallergies and highlights current approaches to their pharmacological management.

Keywords: pseudoallergy, complement, histamine, mast cells, arachidonic acid, leukotrienes, prostaglandins.

1. Introduction

Allergy (Greek: allos, other + ergon, Greek: action) is a qualitatively changed reaction of the body to the action of substances of an antigenic or hapten nature, which is associated with the restructuring of the immune system and is accompanied by a disorder of the function of target organs [2, p. 966].

Pseudoallergy (pseudo - Greek: false) is the development of a pathological process identical to an allergic reaction in terms of clinical manifestations, but without an immunological stage (the substance that caused the reaction is not an allergen, and the reaction occurs without the production of antibodies) [3, p. 94].

In contrast to true allergy, pseudoallergy does not require sensitization, i.e., the reaction occurs at the first entry of the substance into the body [29].

Pseudoallergy has similar and almost identical symptoms to true allergy (Table 1.), among which the most dangerous are: cardiogenic shock, myocardial infarction, ventricular blockade.

Another difference is the rate of development of symptoms: at the beginning of the development of a pseudoallergic reaction, symptoms appear quickly and their severity decreases over time, instead of increasing, as in the case of a true allergy [20, p. 163].

In the pathogenesis of pseudoallergic reactions, mechanisms related to changes in the exchange of histamine and biogenic amines, activation of the complement system and disturbance of fatty acid metabolism and disturbance of the balance between lipid mediators are distinguished [5, p. 56; 6, p. 104].

Table 1

Symptoms of pseudoallergy [20]

Cardiovascular	Broncho-pulmonary	Hematological	Skin	Gastro-intestinal	Neuro-psycho-somatic	Systemic
Angioedema	Apnea					
Arrhythmia	Bronchospasm		Cyanosis		Back pain	
Cardiogenic shock	Cough	Granulocytopenia	Erythema		Chest pain	Chills
Edema	Dyspnea	Leukopenia	Flushing	Bloating	Chest tightness	Sweating
Hypertension	Hoarseness	Lymphopenia	Nasal congestion	Cramping	Confusion	Feeling of warmth
Hypotension	Hyperventilation	Leukocytosis	Rash	Diarrhea	The feeling of imminent death	Fever
Hypoxia	Laryngospasm	Granulocytosis	Rhinitis	Metallic taste	Fear	Loss of consciousness
Myocardial infarction	Respiratory distress	Thrombocytopenia	Swelling	Nausea	Headache	
Ventricular blockade	Sneeze		Tearing	Vomit	Panic	
	Stridor		Urticaria			

1. Historical information

About 100 years ago, during the industrialization of Europe and America, antitoxic serums were introduced into medical practice, which in turn caused strange reactions that were difficult to explain. Few could suspect the influence of the immune system on these disorders. Then the Viennese pediatrician Clemens von Pirke became interested in this problem and on April 2, 1903, in collaboration with Bel Schick, wrote a preliminary report of his theory entitled "On the theory of infectious diseases" ("Zur Theorie der Infektionskrankheiten").

On June 25, 1903, the French immunologist Nicolas Artus conducted an experiment in which he successively injected horse serum subcutaneously into rabbits. He established that with each introduction of a foreign protein (which was non-toxic), the specific sensitivity to it increased.

This experiment contributed to the development of Pirke's idea, then it became clear that the existing concept of immunity at that time was inadequate. So, in 1906, Pirke published an article under the title "Allergy" ("Allergie"). In 1911, he published a monograph in which he clarified that the term allergy should be used for immunological reactions (Figure 1).

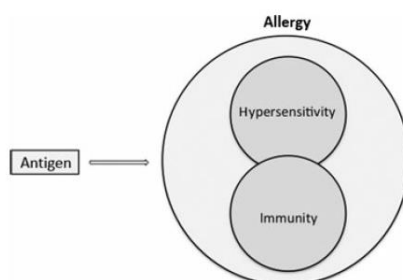


Figure 1. Diagram of von Pirke's initial idea of allergy. According to which, upon contact of the human body with an antigen, there is a change in reactivity. This change can cause a "protective" response that renders the person insensitive to the antigen (immunity) or a "harmful" response that causes symptoms

Pirke's theory has been criticized a lot. The French immunologist Charles Richet believed that it is more appropriate to use the term "anaphylaxis" (from the opposite of "phylaxis" - protection), which he introduced during the study of the individual sensitivity of dogs to toxins.

In 1913, when Richet received the Nobel Prize for the study of anaphylaxis, the term "allergy" began to attract the attention of scientists. As a result, the topic of allergy became very popular, but this recognition caused a "retribution" - the original meaning of the word "allergy" was misunderstood and distorted. Thus, until the middle of the 20th century, this term replaced the concept of anaphylaxis, which was attributed to the properties of immunity, and not to changes in immune reactivity.

Until the 1960s, there were no significant changes in the understanding of the term "allergy". In 1963, Robin Coombs and Philip Jell drew attention to this and in their book "Clinical Aspects of Immunology" provided a new classification of various types of hypersensitivity, distinguishing 4 main types of allergic reactions [1, p. 966]:

Type I - reactive (anaphylactic) - is associated with the formation of highly active antibodies with the participation of IgE. (anaphylactic shock, Quincke's edema)

Type II - cytotoxic - is associated with the formation of antibodies (IgG and IgM) against antigens that are on the surface of the cell or are its components, which leads to the activation of the complement system and the occurrence of complement-dependent cytotoxicity. (hemolytic anemia)

Type III - immune complex - associated with the formation of freely circulating immune complexes in the blood and intercellular fluid with the participation of IgM and IgG, which leads to the activation of the

complement system and the formation of microprecipitates on the vessel walls (Artus phenomenon)

Type IV - delayed - is associated with the formation of sensitized T-lymphocytes (T-effectors), which produce a number of mediators - lymphokines (allergic contact dermatitis, transplant rejection) [2, p. 94].

In the 1970s, the study of histamine release under the influence of dextran or codeine led to the formation of the concept of "pseudoallergy" by the Hungarian immunologist Paul Kahlo. According to this concept, pseudoallergic reactions occur upon first contact with the pathogen (i.e., without prior sensitization) and are clinically very similar to allergic reactions (mainly type I), but occur without the formation of an antigen-antibody complex.

In 2001, the European Academy of Allergology and Clinical Immunology (EAACI) proposed the use of the term "non-allergic anaphylaxis" instead of "pseudoallergic reaction", but the terms are still used interchangeably.

Also in 2001, EAACI made an attempt to standardize the allergological nomenclature. The declaration was supported by the World Organization of Allergology and was revised in 2004 [1, p. 966].

In 2023, EAACI described a novel classification of allergy. According to this classification, there are following mechanisms of allergy:

- Inflammation/immune system-driven mechanisms:
 - Type I (immediate; IgE-depend);
 - Type II (cytotoxic; Complement-depend cytotoxicity, via IgM and IgG);
 - Type III (immune complexes; via IgM and IgG);
 - Cell-mediated mechanisms:
 - Type IVa (T1; Innate immune cells (ILC) 1, Th1, Tc1);

- Type IVb (T2; ILC 2, Th2, Tc2);
- Type IVc (T3; ILC 3, Th17, Tc17);
- Tissue-driven mechanisms:
- Type V (epithelial, associated with resident cells changes, has epigenetic impact);
- Type VI (metabolic, through metabolic-induced immune dysregulation);
- Direct response to chemicals:
- Type VII (direct cellular and inflammatory response to chemical substances) [61, p. 2851].

2. Mechanisms of pseudoallergy

There are 3 mechanisms in the pathogenesis of pseudoallergic reactions:

- Violation of histamine metabolism;
- Activation of the complement system;
- Violation of arachidonic acid metabolism [5, p. 56; 6, p. 104; 7, p. 11].

4. Reactions related to the exchange of histamine

Reactions related to histamine metabolism are the most common and include 4 subtypes:

- Increased release of histamine;
- Consumption of products containing biogenic amines (food);
- Reduction of histamine inactivation;
- Dysbacteriosis [5, p. 56; 7, p. 11].

4.1. Increased release of histamine

Increased release is characteristic of children in the first years of life and is considered a variation of the norm; for adults and older children, it is considered a pathological process [60, p. 185].

The main mechanism of development of this subtype is the release of histamine from mast cells or tissue basophils under the influence of non-immunological factors. It most often occurs in inflammatory processes of the gastrointestinal tract, when conditions are created for the interaction of unprocessed food histamine liberators with mast cells of the submucosal layer of the walls of the gastrointestinal tract. An increase in the concentration of histamine can occur in several ways [5, p. 56; 7, p. 11].

4.1.1 Degranulation of mast cells

In the first case, etiological factors are able to directly affect the dangerous cells and cause their destruction, which is accompanied by the release of allergy mediators. Such factors are defined as non-selective, cytotoxic.

Among the physical factors, high temperature, ionizing and ultraviolet radiation have a pronounced cytotoxic effect; among chemicals - detergents, strong acids and alkalis, organic solvents and quinine.

In the second case, etiological factors cause degranulation of basophils through receptors on the surface of these cells. Such factors are defined as selective, non-cytotoxic [5, p. 56].

These factors include MRGPRX2 (MAS-related G-protein coupled receptor member X2) receptor agonists [8]:

- polymeric amines;
- antibiotics (polymyxin B, vancomycin);
- muscle relaxants (pancuronium, tubocurarine, rocuronium, atracurium);
- radiopaque agents;

- bee venom;
- narcotic analgesics (codeine, morphine, meperidine, fentanyl, hydrocodone, oxycodone) [6, p. 104; 8].

In addition to the above drugs, the following can increase the concentration of histamine:

- antibiotics (D-cycloserine, pentamidine, chloroquine);
- antihypertensive drugs (dobutamine);
- antihypertensive drugs (verapamil, alprenolol);
- diuretics (amiloride);
- local anesthetics (mesocaine, procaine, marcaine, prilocaine);
- anesthetics (barbiturates, thiopental) [4, p. 498].

4.1.2. Systemic mastocytosis

Systemic mastocytosis is a disease characterized by the proliferation of mast cells and their infiltration of the skin and internal organs.

It is characterized by excessive release of mediators, which occurs under the influence of external factors or due to the activation of mast cells.

In many cases, it is caused by a mutation in the D816V gene, which encodes the stem cell factor receptor (c-kit), which is present on mast cells. As a result of this, autophosphorylation occurs, which causes uncontrolled hyperproduction of mast cells [50].

4.1.3. Mast cell activation syndrome

Mast cell activation syndrome is characterized by increased and inadequate activation of mast cells with subsequent release of mediators, but without proliferation of mast cells. Clinical manifestations are similar to systemic mastocytosis.

This disease is based on a low threshold for degranulation of mast cells. The genetic basis has not been proven [50].

4.2. Alimentary way of increasing the concentration of histamine.

The alimentary way of increasing histamine is associated with the use of products that contain histamine and other biogenic amines (tyramine, phenylethylamine) or that can cause an increase in the concentration of histamine in the body. This phenomenon is called "histamine intolerance", which is caused by the inability of the body to inactivate the excess amount of histamine that comes with food.

Products rich in histamine include tomatoes, eggplants, spinach, fish, as well as meat that is stored for a long time; products that contain viable yeast (fresh bread, sourdough), as well as fermented foods (cheeses, sausages, sauerkraut, beer, wine).

Natural histamine liberators include pineapple, banana, citrus fruits, cocoa, strawberries, nuts, papaya, licorice, egg white.

Artificial histamine liberators include various food additives: dyes, preservatives, stabilizers, flavorings [4, p. 498; 5, p. 56].

4.3. Reduction of histamine inactivation.

Reduced inactivation of histamine is associated with a violation of the ways of its neutralization in the body, namely:

- Reduction of binding of free histamine;
- Decreased activity of diamine oxidase;
- Decreased methylation during the studyhistamine N-methyltransferase.

4.3.1. Reduced histamine binding.

Reduced histaminopexy is associated with a decrease in the binding activity of the protein histaminepexin, which binds free histamine in the blood. This phenomenon develops in conditions of intoxication of the body, when the specified protein is involved in the neutralization of toxic products [7, p. 11].

4.3.2. Decreased activity of diamine oxidase.

Diamine oxidase (DAO) is a copper-containing enzyme of the class of oxyreductases, the substrate of

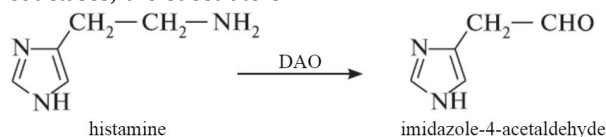


Figure 2. Reaction of histamine oxidation by diamine oxidase.

The oxidation products lack mediator activity and are excreted by the kidneys.

A genetic defect of diamine oxidase can be caused by a mutation in the AOC1 gene, which encodes this protein in the human body [9, p. 63]. A decrease in DAO activity may be associated with defects or inflammation of the intestinal mucosa, in chronic renal failure, viral hepatitis, and chronic urticaria [4, p. 498].

Also, a decrease in activity can be observed against the background of the use of drugs that can inhibit DAO. These drugs include:

- antiarrhythmic drugs (verapamil, propafenone);
- antibiotics (cefuroxime, cefotiam, clavulanic acid, doxycycline, isoniazid, framycetin, metronidazole [11, p. 589], chloroquine);
- antidepressants and antipsychotics (amitriptyline, diazepam, MAO inhibitors, haloperidol);
- antihypertensive drugs (hydralazine);
- antiemetics (metoclopramide);
- diuretics (furosemide);
- bronchodilators (aminophylline, theophylline);

which is diamines, in particular histamine, putrescine and cadaverine, as well as polyamines. This enzyme is present in many tissues, particularly in the kidney, intestinal mucosa and placenta, which have the highest content, but in the central nervous system, this enzyme is absent. In the intestines, diamine oxidase plays a leading role in the detoxification of food diamines, in particular exogenous yeastmine (Figure 2).

- muscle relaxants (tubocurarine, alcuronium, pancuronium) [10, p. 9810];

- antihistamines (promethazine, cimetidine).

Among the food sources of DAO inhibitors, alcoholic beverages can be singled out.

A decrease in the amount of the enzyme may be associated with a deficiency of vitamins B6 and C and trace elements Cu and Zn.

Deficiency of vitamin B6 can be caused by the use of drugs that show antagonism in relation to pyridoxine. These drugs include:

- antihypertensive agent (hydralazine);
- antibiotics (D-cyclosporin, isoniazid);
- hormonal contraceptives (contain estrogens) [9, p. 63].

4.3.3. Decreased activity of histamine N-methyltransferase

The third mechanism is associated with the reduction of histamine methylation by histamine N-methyltransferase, an enzyme of the transferase class, which catalyzes the transfer of the methyl radical from S-adenosyl-L-methionine to the imidazole ring of histamine (Figure 3).

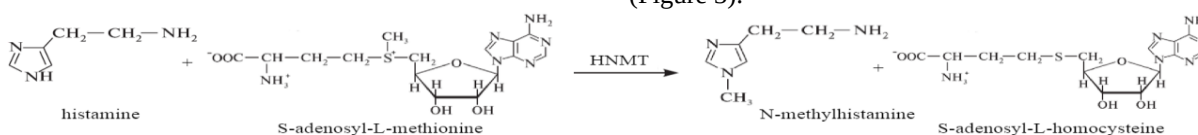


Figure 3. The methylation reaction of histamine with S-adenosyl-L-methionine with the formation of N-methylhistamine and S-adenosyl-L-homocysteine by histamine N-methyltransferase

The content of this enzyme prevails in the central nervous system, where it is the only way to inactivate histamine, and its content in tissues is lower and inferior to the content of DAO [12].

A decrease in the activity of histamine N-methyltransferase can occur against the background of a defect in the HNMT gene encoding this enzyme [15].

Among the drugs capable of inhibiting histamine N-methyltransferase:

- antidepressants (MAO inhibitors - pargyline, clorgyline, deprenyl (selegiline));
- antitumor drugs (dihydrofolate reductase inhibitors - ethoprine, methoprine);
- antimalarials (chloroquine, amodiaquine, quinacrine);

- anticholinesterase agents of central action (tacrine) [14, p. 334].

4.4. Dysbacteriosis

Disturbances in the intestinal microflora can cause an increase in the level of histamine.

Normally, bacteria of the *Bifidobacteriaceae* family, which are obligate anaerobes, antagonize bacteria of the *Proteobacteria* type.

In patients with reduced DAO activity, there is an increased number of bacteria of the type *Proteobacteria*, which are able to form histamine as a result of the histidine decarboxylation reaction under the action of L-histidine decarboxylase (Figure 4).

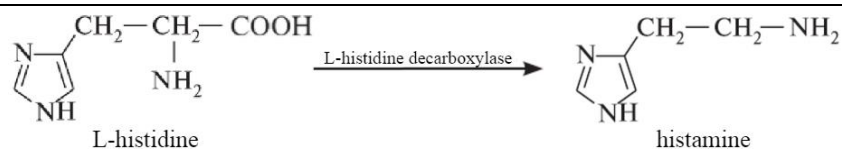


Figure 4. The reaction of histamine formation from histidine under the action of L-histidine decarboxylase.

A number of species that are considered to be potentially probiotic are also capable of producing significant amounts of histamine and other biogenic amines,

such as *Lactobacillus saerimneri* 30a and *Limosilactobacillus reuteri* DSM 17938 (Table 2) [49, p. 2228].

Table 2

Bacteria capable of producing histamine [49]

Bacteria capable of producing histamine [15]		
<i>Acinetobacter</i> spp.	<i>Chryseobacterium</i> spp.	<i>Pediococcus pentosaceus</i>
<i>Alcaligenes faecalis</i>	<i>Klebsiella oxytoca</i> <i>Klebsiella pneumoniae</i>	<i>Proteus</i> spp.
<i>Arizona</i> spp.	<i>Kluyver</i> spp.	<i>Providencia</i> spp.
<i>Cedecea</i> spp.	<i>Morganella morganii</i>	<i>Serratia</i> spp.
<i>Citrobacter freundii</i> <i>Citrobacter braakii</i>	<i>Lactacaseibacillus casei</i> <i>Lactacaseibacillus paracasei</i> <i>Lactacaseibacillus rhamnosus</i>	<i>Pseudomonas putida</i> <i>Pseudomonas lundensis</i> <i>Pseudomonas stutzeri</i>
<i>Edwardsiella</i> spp.	<i>Lactiplantibacillus plantarum</i>	<i>Psychrobacter</i> spp.
<i>Enterococcus casseliflavus</i> <i>Enterococcus faecalis</i> <i>Enterococcus faecium</i>	<i>Lactobacillus curvatus</i> <i>Lactobacillus delbrueckii</i> <i>Lactobacillus helveticus</i>	<i>Raoultella planticola</i> <i>Raoultella ornithinolytica</i>
<i>Enterobacter</i> spp.	<i>Lactococcus lactis</i> ssp. <i>lactis</i>	<i>Salmonella enterica</i> ssp. <i>arizona</i>
<i>Escherichia coli</i> <i>Escherichia fergusonii</i>	<i>Latilactobacillus</i> spp. <i>Lentilactobacillus buchneri</i> <i>Lentilactobacillus hilgardii</i> <i>Lentilactobacillus parabuchneri</i>	<i>Providencia heimbachae</i>
<i>Halomonas</i> spp.	<i>Leuconostoc</i> spp.	<i>Sphingobacterium</i> spp.
<i>Hafnia alvei</i> <i>Hafnia paralvei</i>	<i>Limosilactobacillus reuteri</i> <i>Limosilactobacillus vaginalis</i>	<i>Streptococcus thermophilus</i>
	<i>Microbacterium foliorum</i>	<i>Tetragenococcus halophilus</i>

5. Reactions are associated with the activation of the complement system

The basis of the second mechanism of pseudoallergy is an inadequate reaction of complement, which is associated with the strengthening or inclusion of various ways of its activation.

Soluble proteins of the complement system are synthesized by the liver and circulate in the blood mainly in the form of inactive pro-enzymes, which become active as a result of cleavage by proteases [30, p. 579].

The result of complement activation is the formation of anaphylatoxins C3a, C4a, C5a and mem-

brane attack complex (C5b-9), which provoke degranulation of mast cells and the release of allergy mediators [16].

5.1. Ways of complement activation

In the human body, the complement system can be activated in 3 different ways: classical (antigen-antibody complex), alternative (accelerated breakdown of the C3 component) or lectin (through lectin binding).

Each path has its own specific activators, but each path ends with the formation of anaphylatoxins and a membrane attack complex (Figure 5) [6, p. 104; 30, p. 579].

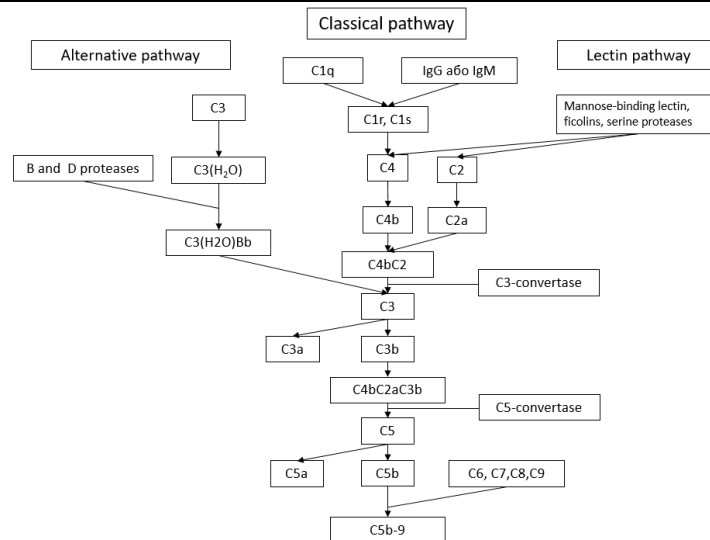


Figure 5. Complement cascade.

5.1.1 The classical way.

The classical pathway of activation depends on antibodies, and is activated when the antibody binds to the antigen. Among antibodies, only IgM and IgG are able to activate the complement system.

The formed antigen-antibody complex connects with the C1q component of complement, which leads to the activation of the C1-complex and the start of the complement cascade [6, p. 104; 19, p. 317].

5.1.2 Alternative path

An alternative way is determined by the ability of some substances (C-reactive protein, viral proteins, polyanions, β -amyloid and others) to activate the complement system in a non-immunological way.

The basis of this mechanism is the spontaneous hydrolysis of the C3 component to form its hydrolyzate C3(H₂O), which is exposed to the action of proteases B and D. The product of their reaction C3(H₂O)Bb, under the action of C3-convertase, is further included in the cascade of reactions, as in the classical pathway.

Under normal conditions, healthy cells have a number of mechanisms that prevent spontaneous hydrolysis of C3 and unwanted activation of the complement system [19, p. 317].

5.1.3. Lectin pathway

Trigger mechanisms in the lectin pathway of complement activation are mannose-binding lectin (MBL) and ficolins, which recognize carbohydrate sequences on the surface of microorganisms.

Each such molecule binds to MBL-associated serine protease (MASP), which has structural similarity to C1s or C1r fragments of complement. MASP-2 cuts C4 and C2 components into C4a and C2a fragments, respectively, which, under the action of C3-convertase, are included in the complement cascade, similar to the classical and alternative pathways [21, p. 785].

5.2. Inadequate complement response

5.2.1. Reinforcement of the classic way

Inadequate enhancement of the classical pathway of complement activation occurs in patients with hereditary angioedema (HANE) [5]. This disease is caused by a mutation in the SERPING1 gene, which encodes C1-esterase inhibitor (C1-INH). In this case, a defective C1-inhibitor with lower activity (C1-INH-HAE) is synthesized in the human body.

There are 2 types of this disease. Mutations causing the first type are spread throughout the gene and provoke precisely the deficiency of C1-INH. The second type is caused by mutations located in the loop of the reactive center of the specified protein and provoke dysfunction of this enzyme.

There are known forms of hereditary angioedema, which is observed against the background of normal level and activity of C1-INH (there is no mutation in the SERPING1 gene), in which case nC1-INH-HAE (SAN with normal C1-inhibitor) is formed.

The appearance of nC1-INH-HAE is caused by a mutation in one of 6 genes (Table 3) [18, p. 2023].

Table 3

Genes which causes nC1-INH-HAE [18]

Gene name	What coding
F12	Factor XII
PLG	Plasminogen
ANGPT1	Angioprotein 1
KNG1	Kininogen 1
MYOF	Myofelin
HSST6	Heparan sulfate glucosamine 3-O-sulfoesterase 6

5.2.2 Non-immunological activation of the complement system.

Among the drugs that can activate the complement system are: liposomal drugs, drugs in micellar solvents,

antibodies, radiocontrast agents; various enzymes, proteins, peptides, etc. (Table 4) [20, p. 163].

Table 4**Medicines capable of activating the complement system and causing pseudoallergy [20]**

Liposomal drugs	Micelle-solubilized drugs	Antibodies	PEGylated protein	Contrast media	Enzymes, proteins, peptides	Miscellaneous
Abelcet AmBisome Amphotec Amphocyl DaunoX-ome Doxil, Caelyx Myocet Visudyne	Cyclosporine Elitec Etoposide Fasturec Taxol Taxotere Vumo	Avastin Campath Erbix Herceptin Infliximab Muro-nomab Mylotarg Remicade Rituxan Vertibix Xolair	Adagen Neulasta Oncaspar Pegaspargase	Diatrizoat Iodipamide Iodixanol Iohexol Iopamidol Iopromide Iothalamate Ioversol Ioxaglate Ioxilan Magnevist Metrizamide SonoVue	Abbokinase ACH Actimmune Activase Aldurazyme Avonex Fasturtec Neulasta Neupogen Plenaxis protamine Urokinase Zevalin	ACE Inhibitors AR blockers Aspirin Cancidas Copaxone Corticosteroids Cyprofloxacin Eloxatin Intralipid Opiates Salicylates Vancomycin

5.2.2.1. Radiocontrast means.

Radiocontrast agents have a complex effect on the activation of the complement system in an alternative way mainly through physical phenomena (charge, hydrophilicity, osmotic pressure) and are able to provoke hydrolysis of the C3 component, inhibit factors H and I, and have a direct effect on the thioester bonds of C3 and C4 components [17, p. 106].

5.2.2.2. Liposomal preparations.

Liposomal drugs (Doxil, etc.) are able to activate the complement system through classical and alternative pathways (the classical pathway of activation prevails). Activation of complement by the classical way in this case may be caused by the binding of the C1q component or C-reactive protein by the phospholipid bilayer.

The formation of liposomal-reactive immunoglobulins can be a powerful trigger or enhancer of the complement cascade, but their presence is not a prerequisite for complement activation by the classical pathway.

Also, Doxil is able to activate factor B and significantly increase the level of the Bb component of complement, which indicates the activation or enhancement of the alternative pathway of complement.

5.2.2.3. Amphiphilic emulsifiers

Solvents containing amphiphilic emulsifiers belong to another group of drugs capable of non-immunologically activating complement. These include semi-synthetic Cremophor EL and synthetic copolymers, such as poloxamer 188 [17, p. 106; 20, p. 163].

Cremophor EL is a nonionic detergent, a complex mixture of unmodified castor oil, polyethylene glycol, amphiphilic polyethoxylated glycerols, polyethoxylated fatty acids and polyethoxylated glycerol esters. It is used as a solvent for drugs that are poorly soluble in water (taxol, cyclosporine, steroids, vitamins A, D, E, K).

Being physiologically inert, this solvent is able to activate the complement system mainly in an alternative way, binding the C3 component with a hydrophilic

surface without the formation of immune complexes. [17, p. 106; 20, p. 163; 22].

Poloxamer is a series of closely interconnected blocks of copolymers of ethylene oxide and propylene oxide. Poloxamer 188 as an emulsifier is part of intravenous preparations in the form of fat emulsions, as well as perfluorocarbon artificial blood substitutes. As an active pharmaceutical component, it is used to treat constipation, kidney stone disease, and to clean the wound surface.

Poloxamer 188 is able to activate the complement system in an alternative way and significantly increase the level of the C5b-9 component due to the binding of the hydrophilic sections of the C3 component with the subsequent launch of the complement cascade [17, p. 106; 23].

5.2.2.4. Polysaccharides

Sugars, glycans and sugar polymers are able to activate the complement system mainly through the lectin and alternative pathways, but the classical pathway through the binding of sugars to the C1q component is also possible [24, p. 1031].

Sugars capable of affecting the complement system in this way include:

- Dextran is a component of blood and plasma substitutes [25].

- Chitosan is a component of mucoadhesive dosage forms and dosage forms with rapid release of the active pharmaceutical ingredient [26].

Polysaccharides capable of inhibiting the complement system include heparin [24, p. 1031].

5.2.2.5. Carbon nanotubes

Carbon nanotubes are cylindrical structures consisting of one or more graphite layers bent into a tube with a hexagonal arrangement of carbon atoms. They are divided into single-walled (SWCNTs), double-walled (DWCNTs) and multi-walled (MWCNTs). In medicine, they are used as drug carriers [27]. Carbon nanotubes are able to activate complement systems in 3 different ways. (Table 5) [24, p. 1031].

Table 5

Classification of carbon nanotubes and their influence on the activation of the complement system [24]

Classical pathway	Alternative pathway	Lectin pathway
SWCNTs: Non-functionalized Iron filled Glycolipid-functionalized RNA-wrapped	SWCNTs: Non-functionalized (little)	SWCNTs: PEGylated PEG-Phospholipid-coated Glycolipid-functionalized
DWCNTs: Non-functionalized Human fibrinogen-coated Tween 20-coated	DWCNTs: Non-functionalized	
MWCNTs: Non-functionalized L-alanine-functionalized Nylon 6-functionalized Ironfilled Glycolipid-functionalized	MWCNTs: L-alanine-functionalized Nylon 6-functionalized	

6. Reactions associated with disturbance of arachidonic acid metabolism

The third mechanism of pseudoallergy is related to a violation of the metabolism of fatty acids, in particular arachidonic acid [5, p. 56]. The main manifestation of such reactions is aspirin-induced asthma.

Aspirin-induced asthma is a syndrome that develops due to the use of aspirin or other nonsteroidal anti-inflammatory drugs (cyclooxygenase (COX) inhibitors). This syndrome is characterized by eosinophilic rhinosinusitis, nasal polyposis, sensitivity to aspirin and asthma, but without the formation of antibodies [32, p. 2417; 33, p. 913].

This mechanism of pseudoallergy is based on a violation of the balance of the cyclooxygenase and lipoxygenase pathways of arachidonic acid oxidation towards the predominant formation of leukotrienes [33, p. 913].

6.1. Ways of metabolism of arachidonic acid

Normally, arachidonic acid released from phospholipids under the action of phospholipase A2 with the participation of COX forms prostaglandins (PG), and under the action of 5-lipoxygenase - leukotrienes (LT) (Figure 6) [35].

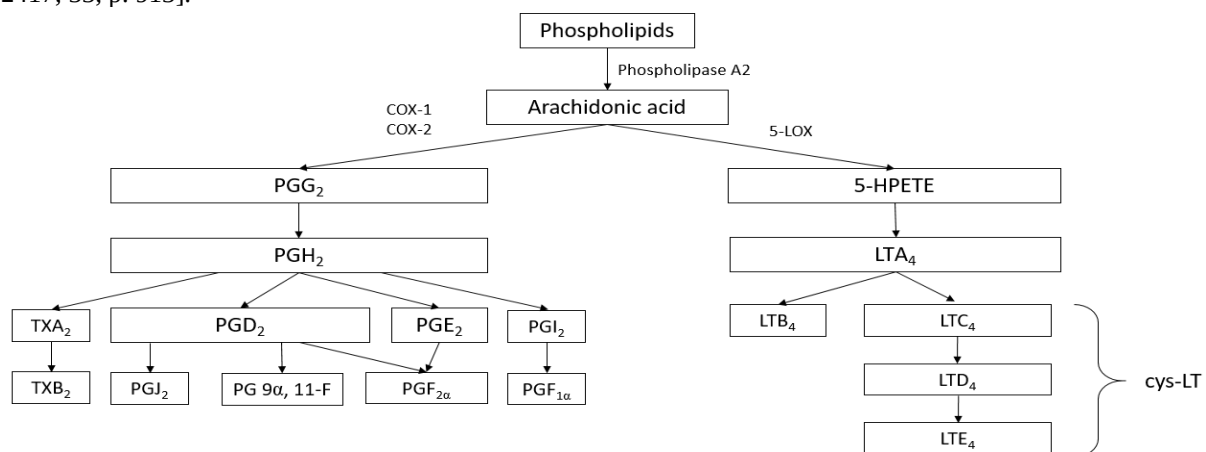


Figure 6. Metabolic pathways of arachidonic acid through the enzymatic actions of COX-1/COX-2 and 5-LOX.

6.1.1. Synthesis of prostaglandins. Cyclooxygenases 1 and 2

COX-1 and COX-2 are isoenzymes responsible for the development of inflammation.

COX-1 is present in tissues and participates in the maintenance of homeostasis (affects gastric mucosa, renal circulation and platelet aggregation).

COX-2 is inducible and directly involved in the development of inflammation. This enzyme is activated

under the influence of external factors (for example, lipopolysaccharide endotoxins) [34, p. 109].

COX-3 is the third isoform responsible for the synthesis of prostaglandins in the central nervous system. This form of COX is not involved in the development of inflammation, but plays a role in the development of fever and pain [38, p. 23].

Among prostaglandins involved in the pathophysiology of aspirin-induced asthma, the following play significant roles:

- PGE₂, which inhibits 5-lipoxygenase activity and reduces LT synthesis [31, p. 259];
- PGD₂, which contributes the development of inflammation in the respiratory tract;
- PGI₂, which prevents the activation of innate immune cells type 2 [46, p. 755];
- 9 α , 11-F₂, which induces bronchoconstriction [36, p. 681].

PGD₂ derivatives - thromboxanes A₂ and B₂ also exhibit bronchoconstrictor properties [41, p. 111].

6.1.2. Synthesis of leukotrienes. Lipoxygenases

At least 6 different lipoxygenases are known in the human body, but of this class of enzymes, 5-lipoxygenase (arachidonate: 5-O-oxygenase) (5-LOX) is associated with human diseases.

This enzyme catalyzes the oxidation reaction of arachidonic acid into 5-hydroxyperoxyeicosatetraenoic

acid (5-HPETE), an intermediate compound in the synthesis of leukotrienes [39, p. 5866-5898] and a key compound in the synthesis of LTA₄. This unstable leukotriene is metabolized through LTA₄ hydrolase to LTB₄, or conjugated through LTC₄ synthase to LTC₄ [40, p. 1].

Among LTs, the leading role in the pathogenesis of aspirin asthma is played by cystenyl LTs (cys-LTs) - LTC₄, LTD₄, LTE₄ [36, p. 681].

6.2. Pathogenesis of aspirin-induced asthma

The basis of the pathogenesis of aspirin asthma is the persistent activation of eosinophils due to the increased production of leukotrienes and the development of type 2 inflammation in the respiratory tract.

The key inflammatory cells in this inflammation are mast cells and eosinophils, which closely interact with other inflammatory and structural cells, including basophils, platelets, and epithelial cells (Table 6.) [42, p. 1147].

Table 6

Mechanisms of aspirin-mediated reactions

Cells	Mediators
- Mast cells Activation during the reaction and release of mediators [43].	- Cys - LT - rapid increase in level during the reaction. They cause the manifestation of the reaction, increase the severity of the course [42].
- Eosinophils/basophils Significant influx into respiratory system tissues during the reaction [36].	- PG D ₂ thromboxanes A ₂ and B ₂ - increased levels. It provokes bronchoconstriction, increases the severity of the reaction [42, 47].
- Platelets Increased activation, increased platelet - leukocyte adhesion, which contributes to the production of cis -LT and PG D ₂ and the manifestation of the reaction [36].	- PGE ₂ – decreased level. Normally, it prevents the degranulation of fatty cells [43].
- Epithelial cells Activated by cis - LT, they produce interleukins (ILs) [45].	- PG I ₂ – level decrease. Normally, it prevents inactivation of innate type 2 lymphoid cells [46].
- Innate immune cells type 2. Activation during the reaction. Produce cytokines. Cause the manifestation of the reaction [45].	- Histamine and tryptase – increased during reactions due to mast cell degranulation . They cause the manifestation of the reaction, increase the severity of the course [36] .

6.2.1 Mast cells

The activation of mast cells has a significant impact on the manifestations of aspirin asthma. The main activators of mast cells are interleukins (IL): IL-33, IL-25 and IL-9 [46]. Under normal conditions, PGE₂, interacting with EP₂ and EP₄ receptors, prevents their activation, however, under conditions of lack of this PG, the ability of mast cells to degranulate increases significantly. Also, the increased activation of mast cells can be caused by an increase in the concentration of Ca²⁺ ions due to an increase in the level of cys-LTs [43, p. 463].

Degranulation of mast cells leads to the release of inflammatory mediators, including PGD₂, however mast cells are not the only source of PGD₂ [44].

6.2.2 Innate immune cells type 2

PGD₂ and cys-LT stimulate innate lymphoid cells of type 2 by interacting with receptors DP₂ (agonist - PGD₂), CysLT₁R and CysLT₂R (agonists - LTC₄ and LTD₄, less active - LTE₄), P₂Y₁₂ and GPR99 (agonist - LTE₄).

Type 2 innate immune cells produce large amounts of IL-4, IL-5, and IL-13. IL-5 provokes the development of eosinophilia, while IL-4 and IL-13, together with cys-LTs and PGD₂, contribute to the development of inflammation in the upper and lower respiratory tract, mucus production, and bronchoconstriction [45, p. 7].

6.2.3. Eosinophils

The number of eosinophils in aspirin asthma in the peripheral blood increases. There is migration of eosinophils into the tissues of the respiratory tract, activation and prolongation of the action of interleukin-5, but unlike eosinophilic inflammation, its concentration does not increase. Activation of eosinophils contributes to the expression of LTC₄ synthase, production of γ -interferon and PGD₂, and sensitivity to NSAIDs, which dose-dependently stimulate the release of these mediators [44].

6.2.4. Platelets

Another source of PGD₂, TXA₂ and cys-LTs are activated platelets after adhesion with leukocytes. Platelet activation occurs under the action of P-selectin

as a result of stimulation of P2Y₁₂ receptors. In addition to the fact that platelets are capable of synthesizing LT, they are able to modulate their synthesis through leukocytes.

Platelets lack 5-LOX, but LTC₄ synthase is sufficient. Neutrophils, in turn, have 5-LOX and are capable of synthesizing excess LTA₄, which is hydrolyzed to LTB₄. When a platelet attaches to a neutrophil, excess LTA₄ is converted to LTC₄ [47, p. 1407].

6.3. Medicinal products that provoke aspirin asthma

Medicines capable of inducing aspirin asthma include NSAIDs capable of inhibiting COX-1.

Non-selective COX inhibitors are poorly tolerated by sensitive patients. These drugs include: ibuprofen, indomethacin, naproxen, fenoprofen, meclofenamate, ketorolac, etololac, diclofenac, ketoprofen, piroxicam, nabumetone, mefenamic acid. Paracetamol in doses below 500 mg is well tolerated.

Drugs that mainly inhibit COX-2 are better tolerated, but in large doses can provoke aspirin-like asthma: meloxicam, nimesulide.

Selective COX-2 inhibitors are well tolerated and do not cause symptoms: etoricoxib, celecoxib, parvocoxib, as well as salsalate and trisalicylate [51, p. 818].

7. Pharmacotherapy of pseudoallergic conditions

Treatment of pseudoallergy is aimed at eliminating its pathochemical and pathophysiological stages.

7.1. Histamine type

7.1.1. Antihistamines

In histamine-type pseudoallergy, the use of antihistamines is not recommended because they selectively block H₁-histamine receptors. This selective blockade can amplify the effects of excess histamine on H₂, H₃, and H₄ histamine receptors. Significant stimulation of these receptors leads to several undesirable effects:

- H₂ receptors: increased gastric juice secretion;
- H₃ receptors: impaired cardiac function and central nervous system depression;
- H₄ receptors: disruptions in hematopoiesis [7, p. 11].

7.1.2. Increased release of histamine

The increased release of histamine can be mitigated through the use of mast cell membrane stabilizers such as ketotifen and sodium cromoglycate [5, p. 56; 7, p. 11].

Degranulation of mast cells can also be inhibited by certain plant-derived compounds that interact with MRGPRX2 receptors (Table 7). Additionally, several synthetic compounds have demonstrated the ability to reduce MRGPRX2-mediated degranulation, including aptamer-X35, roxithromycin, suggamadex, lactic acid, sphingomyelin, and dexamethasone [52, p. 2906].

Table 7

Natural compounds that can affect mast cells through receptors MRGPRX 2

Compound name	Class of chemical compounds
Piperine	Alkaloid
Isoliquiritigenin	Flavonoid
Shikonin	Flavonoid
Imperatorin	Furocoumarin
Paeoniflorin	Terpene
Quercetin	Flavonoid
Resveratrol	Polyphenol
Licochalcone A	Halcon
Ostol	Coumarin

7.1.3. Alimentary way

Enzyme preparations can be prescribed to neutralize food histamine liberators, and sorbents can be prescribed to prevent intoxication [7, p. 11].

Patients should also be prescribed a diet excluding food sources of histamine [53, p. 1181].

7.1.4. Decreased DAO activity

The lack of DAO can be partially compensated by the use of special dietary supplements containing exogenous DAO [53] (HistDAO) [54, p. 185].

7.1.5. Dysbacteriosis

In the case of dysbacteriosis, its correction with pro- and eubiotics is necessary. Also effective is the appointment of lactulose, which on the one hand promotes the development of microflora, and on the other - detoxification of the body [7, p. 11].

7.2. Inadequate complement response

7.2.1 Hereditary angioedema

Since hereditary angioedema is a genetic disease, there is no etiotropic therapy. The treatment strategy is aimed at reducing or preventing attacks and reducing mortality.

In the case of angioneurotic disease caused by C1-INH deficiency, it would be appropriate to administer C1-INH obtained from blood plasma of donors (Synraz drug) or recombinant human C1-INH (Rukonest) [55, p. 391], transfusion of freshly frozen donor plasma (containing C1-INH) is possible. [5, p. 56]. In acute cases, Icatibant (Firazir, Shire) can be prescribed - a blocker of B₂-bradykinin receptors [56].

For prevention, patients can use tranexamic acid (synthetic analogue of lysine) and attenuated androgens (danazol or oxandrolone) [55, p. 391].

7.2.2. Non-immunological complement activation

The complement cascade is characterized by the activation of proteolytic systems, therefore, to inhibit it, it will be appropriate to use proteolysis inhibitors - ε-aminocaproic acid or aprotinin [7, p. 11].

The formation of anaphylotoxins can be reduced by inhibiting a number of enzymes at different stages of their formation:

- Compstatin is a C3-convertase inhibitor
- Eculizumab, pexelizumab - monoclonal antibodies against the C5 component.

In addition to formation, it is possible to block their action:

- Anti-C5a – antibody against C5a anaphylatoxin;
- C5aR-inhibitor, neitrazumab - antagonists of C5a anaphylatoxin receptors.

Activation of the lectin pathway can be stopped by inhibiting serine proteases (nafamostat) and factor D (factor D-inhibitor) [19, p. 317].

7.3. Aspirin asthma

7.3.1. Replacement of NSAIDs

The treatment of aspirin-induced asthma involves the replacement of NSAIDs with more selective ones for COX-2 with the complete exclusion of COX-1 inhibitors (including aspirin) [58, p. 41].

7.3.2. Physiological and saline solutions

In case of chronic rhinosinusitis, it is recommended to rinse the nose with a saline solution or use saline sprays. It is useful to use irrigation to clean the nasal mucosa before the administration of glucocorticoids [57, p. 805].

7.3.3. Nasal glucocorticoids

Systemic and local corticosteroids may be used to block eosinophilic infiltration [57, p. 805; 58, p. 41].

Nasal glucocorticoids: budesonide, fluticasone propionate, mometasone furoate, triamcinolone acetonide, beclomethazone dipropionate, and fluticasone furoate are considered first-line drugs for the treatment of chronic rhinosinusitis caused by the use of NSAIDs. These drugs are highly effective in reducing inflammation, polyp formation, and rhinitis symptoms [57, p. 805].

7.3.4. Antileukotriene drugs

Leukotrienes and their synthesis are targets in the therapy of aspirin-induced asthma.

There are 2 ways: inhibition of 5-LOX and reduction of LT synthesis from arachidonic acid and blocking of CysLTR1 and CysLTR2 receptors.

In the first case, the drug zileuton is used, in the second - montelukast and zafirlukast [59], as well as iralukast, pobilukast, pranlukast [37, p. 338].

7.3.5 Aspirin desensitization

Aspirin desensitization is a provocative procedure that begins with the introduction of increasing doses of aspirin from 650 to 1300 mg over a period of 1 to 3 days, which can provoke hypersensitivity reactions.

Desensitization should be carried out in a well-equipped hospital under the supervision of qualified specialists. A two-day aspirin escalation protocol was approved by the EAACI to improve the efficacy and safety of this procedure [42, p. 1147].

Pregnancy is an absolute contraindication for this procedure. Patients at risk of gastric bleeding should be treated with proton pump inhibitors or misoprostol (a synthetic analogue of PGE₂, which is protective for the sputum mucosa) during the procedure [57, p. 805].

7.3.6. Monoclonal antibodies

Among the new drugs, omalizumab is a monoclonal antibody against IgE, dupilumab is a monoclonal antibody against interleukin IL-4 α receptors, mepolizumab, reslizumab and benralizumab are monoclonal antibodies against IL-5 [42, p. 1147].

7.3.6.1. Omalizumab

Omalizumab binds to IgE and prevents their interaction with high-affinity Fc ϵ RI receptors, and also reduces the expression of these receptors on the surfaces of mast cells and basophils, reducing the ability of mast cells to degranulate. Omalizumab reduces the manifestations of asthma and reduces the need for glucocorticoids and short-term β 2-adrenomimetics, and also improves the condition of patients during the course of aspirin desensitization [42, p. 1147].

7.3.6.2. Dupilumab

Dupilumab inhibits signaling from IL4 and IL13. Its use leads to relief of symptoms in the upper and lower respiratory tract [42, p. 1147].

7.3.6.3. IL-5-targeted monoclonal antibodies.

Mepolizumab and reslizumab prevent the binding of IL-5 to eosinophil receptors. Benralizumab blocks IL-5 receptors by binding to the α -subunit of this protein. Inhibition of these receptors prevents the maturation and migration of eosinophils [42, p. 1147].

7.3.6.4. Promising preparations of monoclonal antibodies.

An additional option in the treatment of aspirin asthma may be promising antibodies: CRTH2 (DP2) antagonist of PGD₂ receptors, anti-IL-33 antibody, and P2Y₁₂-receptor antagonists [42, p. 1147].

Conclusions

Thus, pseudoallergy has its own unique mechanisms of development and a large number of trigger substances, among which there are various drugs and components in their composition, separate groups of drugs and food products.

The basis of pseudoallergy can be already acquired diseases (inflammatory processes in the gastrointestinal tract), including genetic ones (hereditary angioedema, systemic mastocytosis), as well as defects in enzyme systems (defects of DAO, HNMT, etc.).

Pseudoallergy has unique approaches to treatment. Thus, all pharmacotherapy is aimed at eliminating the pathochemical and pathophysiological stages, and drugs aimed at the immune system are much less effective. Approaches to treatment, in turn, differ depending on the mechanism of development of pseudoallergy.

Despite some differences in pathogenesis, pseudo- and true allergy according to the classification of Coombs and Gel are similar in terms of target organs and effector mechanisms. Death most often occurs as a result of cardiac disorders: arrhythmia, ventricular blockade, heart attack and cardiac arrest.

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PEDAGOGICAL SCIENCES

FEATURES OF COMBINING TRADITIONAL AND INTEGRATIVE APPROACHES IN TEACHING PROFESSIONAL-ORIENTED ENGLISH LANGUAGE

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Abstract

This article discusses the relevance of an integrated approach to studying a specialized foreign language within the framework of the basic vocational education program. It is emphasized that learning a foreign language requires studying the culture of another nation and this is, in fact, one of the main reasons for studying languages, which means getting acquainted with the culture of other nations and countries, the worldview of different people. It is noted that as the number of languages studied increases, people's worldview expands and they become stronger and more developed. The main properties of the most frequently used traditional and interactive methods of teaching a foreign language are considered. From the analysis of various theoretical and methodological approaches in pedagogical research and the experiences of many leading researchers in the world, it was revealed that the most effective and appropriate is the methodological approach that leads to the integration of traditional and interactive methods.

Keywords: Integrated approach, oral speech, competence, method, traditional, interactive.

Introduction

Modern achievements in the field of science and technology, coupled with emerging competition on a global scale, have a significant impact on the behavior of young people regarding the promotion of the idea that "a person must be successful" in all spheres of human life. Becoming a specialist after completing various training courses and obtaining a new status does not always mean acquiring new knowledge, skills and qualifications. This trend can be seen even in the field of higher education, that is, receiving a certificate or diploma upon completion of training only means having a document, but does not guarantee that a person has specific skills in this area or his growth in future professional activities.

Today, in higher educational institutions specializing in the field of journalism, there are such common problems as lack of motivation of students to study foreign languages, their lack of desire to master educational material, and inability to make sufficient progress in educational activities. Therefore, one of the important tasks of modern higher education is the formation of a spiritually and intellectually developed personality, striving to be enriched with the values of local and foreign culture, as well as expanding the circle of communication through professional communication with representatives of different cultures. The priority task of students should be the development of mental abilities and the desire not for success only as a status, but for understanding their value to society, for knowledge, respect and veneration of traditions, for preserving the cultural heritage of different nationalities [1]. And the task of a modern teacher in this aspect is very broad and important, because in our time the need to attract the attention and interest of young people is sometimes a difficult task even for the most experienced specialists.

Language teachers always emphasize that learning a foreign language requires learning the culture of another nation. This is, in fact, one of the main reasons for learning languages, which means experiencing the inner culture of another country, learning the worldview of different people and enriching the ability to appreciate different experiences. Language learning and culture cannot be separated, and therefore learning culture and language together is the most effective and successful [2].

There is a saying among people in my nation: "One language-one person", that is, a person who knows one language knows one nation, and a person who knows two languages knows two nations together with their culture, traditions and life style. As the number of languages increases, the person learning them becomes stronger and develops, as well as his worldview expands. People who know different languages can look at things from different angles. Learning a language, of course, requires a good knowledge of vocabulary and syntax. But language teachers sometimes neglect the importance of teaching culture, so the potential of language learning to create cultural understanding is not realized.

It should be noted that the acquisition of basic competencies, including socio-political, communication, information, sociocultural knowledge, skills and qualifications, modern information has become the main goal of personal education in accordance with the requirements of a multicultural world [3]. Among these competencies, the communicative competence of a foreign language is systemic and fundamental for all subjects, since the process of teaching a foreign language organically combines the formation of all other competencies in its development. This is not only a goal, but also a means of effective personal development. Thus, learning a foreign language enriches a person with new

knowledge and helps expand his worldview. This is a source of topics for communication, including topics in a foreign language, which is not without diplomacy and even simplifies the search for common ground for a sincere and effective communication process.

Features of some traditional and interactive methods of teaching a foreign language

The relevance of studying a specialized foreign language within the framework of the basic professional education program for various areas of training future journalists is associated with the need to work with primary sources in a foreign language. Also in formal and informal conditions, in everyday and sociocultural communication, it manifests itself in the implementation of oral communication with representatives of other cultures and nationalities in a foreign language, formal and informal provision of communication, and an adequate response to the characteristics of the interlocutor's oral speech.

The most commonly used traditional approaches to teaching foreign language include grammatical translation, audiolingual approach, direct method, structured approach, task-based language learning, team approach, communicative approach and ESL (English as a secondary language).

There are several effective methods of teaching a foreign language, one of which is teaching a foreign language through grammatical translation. This method has been the only and important part of teaching a foreign language in our country for many years. As a result of the emergence of the communicative method and its subsequent widespread dissemination, teaching a foreign language through translation has become a "traditional" method. But other similar methods, many teaching tools characteristic of communicative activities, have remained as successful teaching methods. When teaching a foreign language through translation, certain results can be achieved by comprehensively practicing these skills, using language as a means of oral and written communication.

The translation method mainly exists in two forms: the grammatical translation method and the text translation method. From the point of view of this method, a foreign language is studied for general educational purposes. Grammar exercises are performed with the aim of developing the logical thinking of the language learner. According to the method, systematic grammatical theory occupies the main place in the content of teaching a foreign language [4].

Using grammatical translation method, the student first learns material in the target language, translating it into his native language. Teachers encourage students to memorize grammar rules and vocabulary. It is important to note that speaking and listening are more or less oriented towards the use of this method. When teachers use this method, they conduct classes in their native language.

In the modern educational process, the method of grammatical translation is used in combination with a communicative approach, which has a relatively good effect on the development of students' oral speech

competence. As a result, students have increasing opportunities to transform themselves from foreign language learners into accomplished language users.

The structural approach, which is considered a traditional approach, studies the various units of language such as sounds, morphemes, words, sentences and vocabulary [5]. It also facilitates the process of learning a language based on grammatical structures [6]. An example of this is first teaching the verb "to be" and then teaching the present continuous tense, where "to be" is used as an auxiliary verb. That is, easy-to-understand grammatical concepts are taught earlier than more complex ones. This approach teaches the four basic language skills: speaking, listening, reading and writing. Teachers can use this technique with many other language teaching methods.

Using the task-based language learning method, students perform real-life tasks using the foreign languages they are learning. In this case, preference is given to fluency in each task completed by the student. Direct error correction has been reduced to increase students' self-confidence.

In the task-based approach to language teaching, tasks are divided into three categories:

- An information gap or task in which information must be transferred from one person, place, or form to another.

- Tasks related to information range that require the learner to discover new knowledge from a given set of information through reasoning, deduction, perception and inference.

- Thought range tasks where students complete a task, expressing their thoughts and feelings about a specific situation.

Activities that can be used in problem-based learning include presentations on a topic assigned in class and conversations with peers or adults in the target language, debates, discussions, newspaper creation, and a short presentation on current events. With this approach, students are given some freedom to explore the language they want to learn. And the teacher usually acts as an observer or instructor [7]. At the same time, learners can also develop self-reflection and teamwork skills.

In the method of learning a foreign language based on collective approach, the audience is perceived as a single whole. Together they learn foreign language skills through practical interaction with each other. In this teaching method, the teacher acts more as an instructor or guide than as a speaker. In general, there is no specific selected activity during the lesson. Instead, students decide what they want to talk about. They sit in a circle and decide what to talk about. But during a conversation, they may ask the teacher for advice on how to translate or pronounce a sentence or idea or how to say something. All conversations are recorded and then transcribed. Students and teacher can analyze grammar and vocabulary as well as content related to the topic.

Another feature of the collective approach method is language exchange, which is used in some bilingual education programs. When switching languages, the message is presented first in your native language and

then in the foreign language you are studying. Students learn the meaning of the words by memorizing parallel meanings in their native language. They summarize the contents of this set of messages. Using this method during training, a student volunteer presents a message to a pre-selected "expert" in his native language. The "expert" translates the message into a foreign language. The student then repeats the message in a foreign language and addresses another student who wants to communicate with him. Although language learning with this method does not fully cover the English language, students learn what they want to learn. Students also play a major role in these activities whenever possible.

Famous methodological researchers, such as Galskova N.D. and Gez N.I., Bim I.L., Passov E.I. and others have developed a communicative approach to teaching foreign languages, emphasizing interactive methods as one of the promising teaching tools [8; 9; 10].

Communicative language teaching can be understood as a set of principles concerning the goals of language teaching, how students learn language, the types of classroom activities that best facilitate learning, and the roles of teachers and students during learning [11]. This approach is one of the interactive teaching methods, the effective use of which makes it possible to turn the student into an active participant in the pedagogical process, to form and develop the student's cognitive activity. The use of interactive methods helps to develop a creative, active personality capable of changing in a developing world.

Thus, in the methodology of communicative teaching of a foreign language, communication performs the functions of training, cognition, development and education as one of the leading types of human activity. In this case, communication serves as:

- 1) source of knowledge;
- 2) a means of individual development;
- 3) a means of developing the necessary personality qualities;
- 4) a way to gain experience and develop interpersonal skills.

Classes organized on the basis of a communicative approach are personality-oriented, and in the process of communication in the lesson, the direct activities of students, their experience, worldview, academic and extracurricular interests and inclinations, and emotions are taken into account [12]. In this case, the activity is based on discussing current life problems, and not on going through topics or studying ready-made texts. At the same time, students will have the opportunity to discuss current events in the life of the audience, the university, the life of the city, the country, and justify and defend their work and actions.

In the process of learning with a communicative approach, students master methods of communication, learn the rules of speech etiquette, strategies and tactics of dialogue and group communication, learn to solve various communicative problems, and become interlocutors in the speech process. The development of thinking in communicative learning is carried out not

by comparison with the native language, but by solving increasingly complex verbal and mental tasks that reflect the content of the communication process [13;14]. As a result, students develop the cognitive and communicative function of communication.

Discussion or debate from interactive teaching methods: debates and discussions on current topics to develop critical thinking and speaking skills, role-playing games and simulations: the use of role-playing games to simulate professional situations and practicing language in real contexts facilitate the achievement of the goal in the educational process.

In this case, multimedia from educational technologies can be used to improve the perception and production of speech: video, audio and other multimedia resources. It is important to use online resources, online platforms and applications for self-study and communication with native English speakers.

Integrative approach to teaching a foreign language

The study of various theoretical and methodological approaches in pedagogical research, the experience of foreign countries and the countries of the former CIS (Commonwealth of Independent States) shows us that the most convenient, logical and expedient integrative approach is a methodological approach that leads to the integration of traditional and interactive methods.

The concept of a system covers mainly the object form of the whole, and the concept of integration covers a process. A complex is a collection of objects, actions, properties or events that are interconnected and form a single whole. And integration means combining parts that are not similar to each other. This preliminary stage of comparison, without going deeply into the descriptive features of each pedagogical approach, allows us to imagine that the essence of integration is wider and deeper than the other two. This creates difficulties, on the one hand, in considering all components and presenting many aspects, and on the other hand, in choosing and taking into account more effective, diverse means and methods in the educational process.

It should be noted that interdisciplinary integration has become widespread and popular in various pedagogical studies, however, the results in this area need further experimental confirmation, since its internal basis and content is the integrity of the educational process. The implementation of an integrative approach involves understanding all four skills of speech and vocabulary with grammar, their essence [15].

Taking into account domestic and foreign experience in foreign language teaching methods, we can distinguish three main approaches to professional - oriented teaching of a foreign language [16;17;18]. Of these:

- 1) foreign language for specific purposes;
- 2) subject-language integrated education;
- 3) teaching specialized subjects in a foreign language.

ESP (English for specific purposes) approach is actively used in the traditional system of teaching a foreign language at a university, the goal of which is the formation of professional linguistic competence. It consists of mastering the grammatical means of professional speech, special vocabulary and vocabulary. The subject of study is a foreign language, which is mainly taught for the purpose of mastering professional vocabulary and speech expression in the professional field [19].

The implementation of an integrative approach to interaction in the educational process involves the use of various pedagogical methods (for example, the project method), interpersonal interaction of students, the development of communication skills, cooperation, co-creation, and the acquisition of skills in finding a balance in human relationships [20]. This, in turn, teaches communication skills and contributes to positive experiences of intercultural interaction [21]. Maintaining cultural connections at a high level requires a re-evaluation of intercultural connections and cultural identity based on the ideas of intercultural tolerance, understanding of cultural differences and acceptance of communication as equal.

Thus, English for specific purposes is taught in universities in our country, taking into account the specific needs of various specialties and socio-economic requirements.

Therefore, particular attention should be given to developing a variety of English language and practical skills to help students achieve better results both academically and in the workplace. For example, English language learners must learn to decode and comprehend certain types of English texts by completing reading comprehension tasks. However, although the integrative approach to foreign language teaching is widely used in some developed countries, in our country it is still at the implementation stage. This is a natural phenomenon because any new approach to higher education will inevitably face problems during the creation phase. Therefore, it is important to determine the basis on which specialists conducting research in this direction will be guided.

In the process of teaching English for specific purposes, it is necessary to pay attention to the following procedures of the assessment and control process:

- Formative assessment: regular feedback and assessment of student performance through tests, questionnaires and oral examinations.
- Summative assessment: final assessment of students' knowledge and skills through exams, public speaking and project defense.

The development of students' oral speech competence in the process of teaching English for specific purposes requires the integration of theoretical and methodological foundations that ensure the successful development of communication skills in a foreign language.

Focusing on the theoretical foundations of the theory of linguistics:

- phonetics: study of the sound system of the English language, correct pronunciation and intonation;

- vocabulary: study of a wide range of vocabulary, including terms and expressions specific to the professional field;

- grammar: mastering grammatical structures necessary for clear and grammatically correct expression of thoughts.

Focusing on psycholinguistic foundations:

- psychological aspects of language acquisition: understanding the mechanisms of speech perception and production, the role of memory and cognitive processes in learning;

- motivational-emotional factor: it is important to take into account the influence of motivation, confidence and emotional state on the success of language acquisition.

If we look at the basics of communication theory:

- communicative approach: focusing on the functional aspects of language, using language for real communication, modeling communication situations;

- interactivity: interaction between students should be recognized, active participation in dialogues and discussions to develop speaking skills.

As a methodological basis, it is permissible to list the following:

- project-oriented approach: projects and presentations, development and presentation of projects in the major in English.

- research activities: performing research assignments and writing scientific articles in English.

Conclusion

Thus, it turns out that the targeted use of an integrative approach in the educational process can significantly increase the effectiveness of teaching English at a university. The successful development of students' oral speech competence during profile-oriented teaching of English language requires an integrated approach, including theoretical and methodological aspects. The combination of linguistic, psycholinguistic and communication theories with innovative teaching methods and technologies makes it possible to create favorable conditions for the formation and improvement of speech skills necessary for professional and educational activities.

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FORMATION OF ENVIRONMENTAL COMPETENCE OF JUNIOR SCHOOLCHILDREN IN THE LESSONS OF THE INTEGRATED COURSE "I EXPLORE THE WORLD"**Filimonova T.**

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ФОРМУВАННЯ ЕКОЛОГІЧНОЇ КОМПЕТЕНТНОСТІ МОЛОДШИХ ШКОЛЯРІВ НА УРОКАХ ІНТЕГРОВАНОГО КУРСУ «Я ДОСЛІДЖУЮ СВІТ»**Філімонова Т.**

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Abstract

The article considers the problem of forming the ecological competence of younger schoolchildren in the lessons of the integrated course "I explore the world".

It is noted that the ecological competence of younger schoolchildren is an important aspect of their education and development, which determines their ability to understand, evaluate and interact with the environment in a conscious and responsible way.

The development of environmental competence in younger schoolchildren in the educational process is carried out within the framework of mastering the educational subject "I explore the world", which provides opportunities for the formation of all the above-listed elements of environmental competence.

The integrated course "I Explore the World" is aimed at the formation of key and subject competencies, including environmental competence, which involves awareness and compliance with the rules of environmental behavior; civic and social competence, which involves cooperation with other people to achieve a common goal, activity in the life of the class and school, showing respect for the rights of other people, the ability to act in conflict situations, caring for one's own health and preserving the health of other people, adherence to a healthy lifestyle; knowledge of oneself and the world around us through observation and research.

It was found that the formation of environmental awareness in the process of studying the discipline "I explore the world" should be ensured by a close connection between school education and life, which makes it possible to better understand natural phenomena and their relationships; it involves children in active participation in nature protection.

Анотація

У статті розглянуто проблему формування екологічної компетентності молодших школярів на уроках інтегрованого курсу «Я досліджую світ».

Зазначено, що екологічна компетентність молодших школярів – це важливий аспект їхньої освіти та розвитку, який визначає їхню здатність розуміти, оцінювати та взаємодіяти з навколишнім середовищем у свідомий і відповідальний спосіб.

Розвиток екологічної компетентності у молодших школярів в освітньому процесі здійснюється в межах засвоєння навчального предмету «Я досліджую світ», який надає можливості для формування всіх вище перелічених елементів екологічної компетентності.

Інтегрований курс «Я досліджую світ» спрямований на формування ключових та предметних компетентностей, у тому числі – екологічної компетентності, що передбачає усвідомлення і дотримання правил природоохоронної поведінки; громадянські та соціальні компетентності, що передбачають співпрацю з іншими особами для досягнення спільної мети, активність у житті класу і школи, виявлення поваги до прав інших осіб, уміння діяти в конфліктних ситуаціях, дбайливе ставлення до власного здоров'я і збереження здоров'я інших людей, дотримання здорового способу життя; пізнання себе і навколишнього світу шляхом спостереження та дослідження.

З'ясовано, що формування екологічної свідомості в процесі вивчення дисципліни «Я досліджую світ», повинно забезпечуватись тісним зв'язком шкільного навчання з життям, що дає можливість краще зрозуміти природні явища, їхні взаємозв'язки; залучає дітей до активної участі в охороні природи.

Keywords: ecological competence, formation of ecological competence of junior schoolchildren, New Ukrainian School, integrated course "I explore the world."

Ключові слова: екологічна компетентність, формування екологічної компетентності молодших школярів, Нова українська школа, інтегрований курс «Я досліджую світ».

Постановка проблеми. Екологічна освіта є питанням сьогодення та пріоритетом на майбутнє. Через недостатню увагу до екологічної освіти в школах та інших навчальних закладах, рівень екологічної компетентності населення є низьким. Більшість людей не розуміють важливості збереження природи і не знають, як правильно поводитися в навколишньому середовищі.

Екологічній освіті приділяється все більше уваги на всіх рівнях освіти. Люди з екологічною культурою вирізняються здатністю гармонізувати як зі своїм внутрішнім, так і з природним середовищем. Ця здатність формується в дитинстві через професійні знання, емоційний розвиток, практичні навички природоохоронної діяльності та формування моральних цінностей. Ці цінності включають почуття відповідальності за природу і життя та внутрішнє переконання в необхідності захисту природи. У цьому контексті школа відіграє все більш важливу роль у формуванні екологічної компетентності населення, яка є необхідною складовою сучасного суспільства.

Це пов'язано з тим, що екологічний досвід у перші роки життя визначає здатність прогнозувати майбутню діяльність у природі та наслідки поведінки в навколишньому світі.

Досвід впровадження екологічної освіти в Україні зростає, але екологічна освіта дітей молодшого шкільного віку все ще здійснюється з недостатньою ефективністю. Ухвалення Державного стандарту початкової освіти (редакція 2018 року) змінило пріоритетність природничих дисциплін і визначило екологічну компетентність як базову. Ця компетентність передбачає усвідомлення основ екологічного природокористування, дотримання правил поведінки в довкіллі та ощадливого використання природних ресурсів з розумінням важливості збереження природи для сталого розвитку суспільства.

Реформа внесла суттєві зміни у зміст освіти загалом і в предметний зміст природничих дисциплін зокрема. Відповідно до нового Державного стандарту освіти введено курс «Я досліджую світ», який є інтегрованим курсом, що поєднує зміст різних освітніх галузей (природничої, громадянської та історичної, соціальної та здоров'язбережувальної освітньої галузі).

Аналіз останніх досліджень та публікацій. Теоретичну основу сучасних досліджень проблеми формування екологічної компетентності учнівської молоді у філософсько-культурологічному й психолого-педагогічному аспектах становлять: висновки і положення щодо гуманізації сучасної освіти (В. Андрущенко, Г. Балл, І. Бех, Б. Гершунський, С. Гончаренко, І. Зязюн, В. Кремень та ін.); теорії неперервної екологічної освіти і виховання (С. Глазачев, М. Дробноход, Г. Каропа, М. Кисельов, В. Крисаченко, М. Мамедов, М. Мойсєєв, Г. Пустовіт, О. Сластьонін та ін.); результати педагогічних досліджень у галузі екологічної освіти і виховання дітей та молоді (О. Біда, Л. Білик, І. Костицька, О. Колонькова, Л. Лук'янова, Г. Марченко, Т. Нінова, О. Плахотнік, Н. Пустовіт, С. Скрипник, С.

Совгіра, А. Степанюк, Г. Тарасенко, В. Червонецький, С. Шмалей та ін.). Теоретичним та практичним аспектам екологічного виховання учнів у закладах освіти різних типів приділяється значна увага сучасних науковців. Про це свідчать праці А. Захлебного, І. Зверєва, І. Суравегіної (методологічні положення екологічної освіти і виховання), А. Волкової, Г. Волошиної, В. Коваль, С. Лебідь, В. Шарка (особливості екологічної освіти і виховання в процесі вивчення окремих шкільних предметів), Г. Пустовіта (дослідницька робота учнів з екології в позашкільних установах) тощо.

Мета дослідження – розкрити проблему формування екологічної компетентності молодших школярів на уроках інтегрованого курсу «Я досліджую світ».

Виклад основного матеріалу. Екологічна компетентність дітей молодшого шкільного віку є важливим аспектом їхньої освіти та розвитку, що визначає їхню здатність розуміти, цінувати та взаємодіяти з навколишнім середовищем у свідомий та відповідальний спосіб. Це поняття включає в себе багато елементів, які є ключовими для захисту природи та створення сталого майбутнього для планети.

Зміст екологічної компетентності включає розуміння основних принципів і моделей екосистем, вміння визначати вплив своїх дій на природу та здатність приймати обґрунтовані рішення щодо захисту довкілля. Сюди входять знання про види рослин і тварин, екосистемні процеси, відновлювані та невідновлювані природні ресурси та вміння застосовувати ці знання на практиці.

Науковці розглядають компетентність як вигоду до освіти та навчання людини, тобто як сукупність узагальнених форм поведінки, що гарантують ефективне виконання певної діяльності.

З цієї точки зору екологічну компетентність слід визначати як систему нормативних вимог до рівня освіченості учнів щодо розв'язання екологічних проблем і забезпечення охорони та сталого відтворення життя. На думку дослідників, екологічна компетентність включає здатність учнів проектувати та організовувати власну навчальну діяльність з урахуванням таких факторів, як просторові, предметні та часові умови, взаємозв'язки між навчальними об'єктами, державні стандарти та вимоги навчальної програми, індивідуальні ресурси учнів, навчальне навантаження, а також наслідки для здоров'я та екологічної безпеки. Таким чином, екологічна компетентність є результатом екологічної освіти.

Значення екологічної компетентності:

1. Екологічна компетентність вчить дітей ефективно використовувати природні ресурси, зменшувати кількість відходів та мінімізувати негативний вплив на довкілля. Це сприяє сталому розвитку, що є ключовим питанням для забезпечення якості життя майбутніх поколінь.

2. Екологічні компетентності допомагають молодшому поколінню зрозуміти вплив забруднення, хімічних речовин та інших факторів навколишнього середовища на здоров'я людини. Освічені

учні можуть вжити заходів, щоб уникнути небезпечних ситуацій і захистити своє здоров'я.

3. Участь в екологічних ініціативах, лобювання законодавчих змін та сприяння змінам у поведінці споживачів.

4. Розуміння важливості видового та екосистемного різноманіття є важливою частиною екологічної компетентності. Учні, які розуміють це, можуть більш ефективно захищати зникаючі види та території природного різноманіття.

5. Екологічні компетентності допомагають запобігати екологічним загрозам і стихійним лихам, таким як повені, зсуви, посухи та наслідки зміни клімату. Вони також допомагають зрозуміти, як адаптуватися до змін у природному середовищі та пом'якшити їх наслідки.

6. Екологічна освіта та розвиток екологічних компетенцій дітей є важливими елементами у формуванні ставлення молоді до природи. Це призводить до появи більш свідомих та відповідальних громадян.

7. Захист природи та стале використання ресурсів, що забезпечується екологічними компетентностями, покращують якість повсякденного життя.

Важливим елементом екологічної компетентності є не лише теоретичні знання, а й практичне застосування. Знання та досвід, набуті в практичній діяльності у сфері охорони довкілля, сприяють формуванню екологічної компетентності на різних рівнях. Тому ефективний розвиток екологічної компетентності визначається якістю отриманих знань та їх застосуванням у житті кожної людини.

На підставі дослідження Л. Біленкової [1, с. 10] можемо відзначити, що розвиненість екологічної компетентності у дітей може виявлятися через різні види діяльності:

1. У рольових іграх, що відображають різні природні сценарії та діяльність дорослих у природі.

2. У практичній діяльності, спрямованій на створення або підтримку умов для живих об'єктів у зеленій зоні дитячого садка (праця в природі).

3. В діяльності з відновлення предметів, таких як ремонт іграшок, книг та інших, яка, хоч і не прямо, але пов'язана з збереженням природних ресурсів.

4. У створенні образів у сфері образотворчого мистецтва на основі вражень від природи або діяльності людей в природі.

5. У спілкуванні з природою, в добровільному контакті з об'єктами рослинного і тваринного світу, що включає спостереження, оціночні судження, милування, догляд, приручення і дресирування тварин.

6. У проведенні експериментів, що представляє собою практичну пізнавальну діяльність з об'єктами природи, супроводжується спостереженням і висловлюваннями щодо отриманих результатів. Експериментування з живими об'єктами є позитивною, якщо пошукові дії враховують потреби живих істот і не завдають їм шкоди.

7. У мовній діяльності, такій як питання, повідомлення, участь у бесіді, діалозі, обмін інформацією, враженнями, уточнення уявлень про природу за допомогою слова.

8. У спостереженні, яке є самостійною пізнавальною діяльністю, що забезпечує отримання інформації про природу та діяльність людей в природі.

9. У перегляді книг, картин, телепередач природознавчого змісту, що сприяє отриманню нових і уточненню наявних уявлень про природу.

Теоретичною основою формування екологічної компетентності учнів є методологія компетентнісного підходу:

- Навчання розв'язувати соціально значущі та важливі завдання і проблеми шляхом оволодіння новими видами діяльності та методам;

- Посилення особистісної орієнтації освіти, тобто створення ситуацій вибору на основі інтересів і потреб учнів;

- Активізація процесу навчання шляхом надання можливості учням шукати, відкривати і будувати власні знання;

- Ознайомлення та залучення учнів до різних видів діяльності;

- Орієнтація на особистісний розвиток учнів.

Розвиток екологічної компетентності учнів середньої школи в освітньому процесі відбувається в рамках навчального предмету «Я досліджую світ», яка надає можливість сформувати всі вищезазначені елементи екологічної компетентності.

Затверджено дві модельні освітні програми за новими державними стандартами: НУШ1 (автор О. Савченко) та НУШ2 (автор Р. Шайєнн). Інтегрований курс «Я досліджую світ» об'єднує навчальний зміст різних освітніх дисциплін. Типова програма НУШ1 складається з трьох дисциплін: природничі науки, громадянство та історія, соціальна і здоров'язбережувальна освіта; типова програма НУШ2 складається з семи дисциплін: мови і літератури, математики, природничих наук, технологій, соціальної і здоров'язбережувальної освіти, громадянства та історії, інформатики [4].

У типовій навчальній програмі НУШ 1 зазначено, що природнича, громадянська та історична, соціальна та здоров'язбережувальна освітня галузь можна викладати як окремі предмети або як інтегрований курс, активно використовуючи міжпредметні зв'язки та застосовуючи різні види інтеграції (тематичну, процесуальну, міжпредметну, у межах навчальної дисципліни, інтегровані уроки, тематичні дні, проектну діяльність тощо), організовувати та впроваджувати різні форми взаємодії учнів. Якщо обрано інтегрований курс «Я досліджую світ», то в навчальній програмі визначаються мета, завдання та зміст, які комплексно охоплюють компоненти кожної з вищезазначених дисциплін.

Відповідно до типової навчальної програми НУШ 2, інтегрований курс «Я досліджую світ» поєднує сім галузей: мовно-літературну, математичну, природничу, технологічну, соціальну та здоров'язбережувальну, громадянську та історичну, інформатичну. У платформі Ed-Era для підготовки

вчителів початкової школи один із тематичних модулів присвячений інтегрованому навчанню. Згідно зі звітом, інтегрований урок під назвою «Я відкриваю світ» має на меті розширити соціальний досвід учнів. Інтегрований урок сприяє активному розвитку природничо-наукової і технологічної грамотності на основі конкретного досвіду розв'язання проблем, звернення до знань про природу і суспільство, ціннісних орієнтацій і методів дослідження в різних сферах життя [4].

Метою цієї навчальної дисципліни є особистісний розвиток молодших школярів на основі формування цілісного образу світу в процесі засвоєння різних видів соціального досвіду, який охоплює систему інтегрованих знань про природу і суспільство, ціннісні орієнтації в різних сферах життєдіяльності та соціальної практики, способи дослідницької поведінки, які характеризують здатність учнів розв'язувати практичні задачі.

Одним із завдань дисципліни є засвоєння доступних методів пізнання себе, об'єктів і явищ природного та суспільного життя (спостереження, обстеження, експеримент, практика, вимірювання, систематизація, класифікація, визначення логічної та часової послідовності подій, критична оцінка побаченого (і почутого), визначення зв'язків і залежностей у природі та суспільстві, стан навколишнього середовища (зв'язки між видами людської діяльності, вплив поведінки на здоров'я та безпеку, залежність результатів від докладених зусиль) та формування дослідницьких умінь.

Інтегрований курс «Я досліджую світ» спрямований на розвиток «екологічної компетентності», яка полягає у визнанні та дотриманні правил поведінки в довкіллі, «громадянської та соціальної компетентності», яка полягає у співпраці з іншими для досягнення спільних цілей у класі та шкільному житті, повазі до прав інших, умінні діяти в конфліктних ситуаціях, турботі про власне здоров'я та здоров'я інших, формуванні навичок здорового способу життя, а також на розвиток ключових і предметних компетентностей.

Формування екологічної свідомості - це процес, який залежить від низки факторів, таких як свідоме ставлення до навколишнього середовища, усвідомлення необхідності дбайливого ставлення до природи та збалансованого використання ресурсів. Як показує практика, формування екологічної свідомості в процесі навчання курсу «Я досліджую світ» має забезпечуватися тісним зв'язком шкільної освіти з життям, щоб природні явища та взаємозв'язки між ними були краще зрозумілі, а діти стали активними учасниками захисту природи.

Загалом змістові педагогічні основи розвитку екологічної компетентності молодших школярів на уроках «Я досліджую світ» ставлять перед педагогом обов'язок дотриматись таких вимог:

1. Розвиток екологічної компетентності повинен мати природоохоронну спрямованість;
2. Краєзнавчий матеріал повинен систематично та комплексно використовуватись в позакласній та класній діяльності молодших школярів;

3. Молодші школярі включаються в дослідницьку краєзнавчу діяльність екологічної спрямованості;

4. В процесі розвитку екологічної компетентності молодші школярі повинні набувати досвіду ціннісних орієнтацій та оціночних суджень;

5. На основі природоохоронної діяльності, учні повинні оволодівати трудовими вміннями щодо покращення навколишнього природного середовища, засвоювати та реалізовувати правила та норми поведінки в природі.

На уроках «Я досліджую світ» найбільш доцільним методом на першому етапі розвитку екологічної компетентності молодших школярів є аналіз і зміна їхніх цінностей, інтересів і потреб у ставленні до довкілля. Спираючись на спостереження та досвід природоохоронної діяльності учнів, вчитель намагається викликати їхні емоційні реакції та сформувати особисте ставлення до екологічних проблем за допомогою фактів, цифр і суджень.

Особливу роль на етапі формування екологічних проблем відіграють методи, що стимулюють самостійну діяльність учнів. Завдання і проблеми спрямовані на виявлення протиріч у взаємодії суспільства і природи, формулювання проблем і генерування ідей щодо їх вирішення з урахуванням концепції об'єкта дослідження. Навчальна діяльність значною мірою стимулюється через дискусію, що сприяє особистому ставленню учнів до проблеми, знайомству з реальними місцевими екологічними умовами та пошуку шляхів її вирішення.

На етапі теоретичної демонстрації того, як суспільство гармонійно взаємодіє з природою, вчителі використовують методи сторітелінгу, які дозволяють показати наукові основи охорони природи широко і багатогранно, з урахуванням факторів глобального, регіонального та локального рівня. Пізнавальна діяльність сприяє моделюванню екологічного контексту морального вибору, узагальненню досвіду прийняття рішень, формуванню ціннісних орієнтацій та розвитку інтересів і потреб учнів. Стимулюється потреба учнів виражати свої естетичні почуття та переживання у творчій формі (малюнки, оповідання, вірші). Мистецтво допомагає компенсувати багато логічних елементів когнітивізму. Цілісний підхід до дійсності та емоційність, притаманні мистецтву, особливо важливі у формуванні мотивації до вивчення та захисту природи.

Висновки. Основою екологічної компетентності є сукупність набутих знань у галузі екології та практичного досвіду природоохоронної діяльності, що має особистісно-орієнтований і діяльнісний характер. Основними функціями екологічної компетентності є формування екологічного розуміння зв'язків, що існують між системами «людина-природа-соціум»; формування ціннісного ставлення до природи; формування сукупності знань, умінь і навичок щодо алгоритмів і стратегій взаємодії з довкіллям. Робота з формування екологічної компетентності ґрунтується на таких аспектах, як здоров'я-збережувальний, ціннісно-контекстний,

інтегративний, громадянський, соціальний та діяльнісний.

Отже, екологічна компетентність учнів початкової школи включає розуміння таких базових понять, як екосистеми, біорізноманіття, взаємодія між видами, кругообіги речовини та енергії в природі. Учні з екологічною компетентністю розуміють, як усе в природі взаємопов'язане і які наслідки може мати порушення цих взаємозв'язків. Це також означає, що учні усвідомлюють свій особистий вплив на довкілля, наприклад, розуміють, як їхні дії, споживання та вибір можуть призвести до забруднення, виснаження природних ресурсів та зміни клімату. Окрім теоретичних знань, важливим компонентом екологічної компетентності є також їх практичне застосування. Знання та практичний досвід у сфері охорони довкілля сприяють формуванню цієї компетентності на різних рівнях. Тому ефективний розвиток екологічної компетентності залежить від якості отриманих знань та їх застосування в житті студента.

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THE CHALLENGES OF TEACHING WITH TECHNOLOGY

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Shanghai, China*<https://doi.org/10.5281/zenodo.14766570>**Abstract**

This study extends previous research by examining how technology integration influences the types of knowledge teachers must consider in their practice. It aims to explore the implementation of technology-related professional knowledge in educational settings. The paper discusses three core components of language teaching with technology: content knowledge, pedagogical knowledge, and technological knowledge, as well as their interactions.

Keywords: challenges, language teaching, technologies, classroom context.

As educators are aware, teaching is a complex practice that requires the integration of multiple forms of specialized knowledge. Thus, teaching can be classified as an ill-structured discipline, requiring teachers to apply complex knowledge structures across different scenarios and contexts. Teachers work in dynamic classroom environments that necessitate constant adaptation and refinement of their understanding. Effective teaching, therefore, relies on flexible access to well-organized, integrated knowledge across various domains [4, p. 93-94; 7, p. 5; 9, p. 14], including student learning processes, subject matter expertise, and, increasingly, technological proficiency.

Teaching with technology is complicated further when the challenges newer technologies present to teachers are considered. In the article, the word *technology* applies equally to analogue and digital, as well as new and old, technologies.

Most traditional pedagogical technologies are characterized by specificity (a pencil is for writing, for instance); stability (pencils and chalkboards have not changed a great over time); and transparency of function (the inner workings of the pencil or a chalk are simple and directly related to their function) [8]. Over time, these technologies have become commonplace and, in most cases, are not even considered to be technologies. Digital technologies – such as computers, handheld devices, and software applications – by contrast, are protean (usable in many different ways [6], unstable and rapidly changing. On an academic level, it is easy to argue that a pencil and a software simulation are both technologies. The latter, however, is qualitatively different in its functioning to teachers and offers fundamentally less stable than more traditional technologies. By their very nature, newer digital technologies, present new challenges to teachers who are struggling to use more technology in their instruction.

Also complicating teaching with technology is an understanding that technologies are neither neutral nor unbiased. Thus, particular technologies have their own propensities, potentials, affordances, and constraints

that make them more suitable for certain tasks than others [1; 2]. Using emails to communicate, for example, affords asynchronous communication and easy storage of exchanges. Email does not afford synchronous communication in the way that a phone call, a face-to-face conversation, or instant messaging does. Nor does email afford the conveyance of subtleties of tone, intent, or mood possible with face-to-face communication. Understanding how these affordances and constraints of specific technologies influence what teachers do in their classrooms is not straightforward and may require further teacher professional development.

Social and contextual factors also complicate the relationships between teaching and technology. Social and institutional contexts are often unsupportive of teachers' efforts to integrate technology use into their work. Teachers often have inadequate or inappropriate experience with using digital technologies for teaching and learning. Many teachers earned degrees at a time when educational technology was at a very different stage of development than it is today. Thus, it is not surprising that they do not consider themselves sufficiently prepared to use technology in the classroom and often do not appreciate its value or relevance to teaching and learning. Acquiring a new knowledge base and skill set can be challenging, particularly if it is a time-intensive activity that must fit into a busy schedule. Moreover, this knowledge is unlikely to be used unless teachers can conceive of technology uses that are consistent with their existing pedagogical beliefs [3]. Furthermore, teachers have often been provided with inadequate training for this task. Many approaches to teachers' professional development offer a one-size-fits-all approach to technology integration when, in fact, teachers operate in diverse contexts of teaching and learning.

Given these challenges, how can teachers effectively integrate technology into their teaching? A successful approach must acknowledge that teaching is a dynamic interaction between what teachers know and how they apply this knowledge within the unique circumstances of their classrooms [5]. There is no single

'best method' for incorporating technology into curricula; rather, integration strategies must be creatively tailored to specific subject matter and classroom settings.

Since teaching with technology is a complex and evolving task, educators must develop new frameworks for understanding and managing this complexity. In this regard, three core components play a crucial role in language teaching with technology: content knowledge, pedagogical knowledge, and technological knowledge. The interplay among these components, which varies across different educational contexts, accounts for the wide discrepancies in the effectiveness of technology integration.

Content knowledge refers to a teacher's expertise in the subject matter they teach. The curriculum for middle school language instruction, for instance, differs significantly from that of an undergraduate language course. As Shulman noted, this knowledge includes concepts, theories, ideas, organizational frameworks, evidence, and established methods for developing subject expertise [9].

In the context of language teaching, content knowledge encompasses essential aspects such as curriculum design, assessment strategies, learning conditions, and the interconnections between pedagogy and evaluation. Teachers must have a deep understanding of their subject matter and how best to convey it to students, ensuring that instructional methods align with the core principles of language acquisition.

Pedagogical knowledge involves an educator's expertise in teaching methodologies, instructional strategies, and classroom management techniques. This knowledge extends beyond subject-specific instruction to include general principles of learning, student engagement techniques, lesson planning, and assessment methods.

A teacher with strong pedagogical knowledge understands how students construct knowledge, acquire skills, and develop critical thinking abilities. Furthermore, they recognize the importance of fostering an inclusive, interactive, and adaptive learning environment. Effective teaching, therefore, requires an understanding of cognitive and social learning theories and their application in classroom settings.

Additionally, pedagogical knowledge includes an awareness of common student misconceptions, strategies for building connections between different content areas, and the importance of prior knowledge in shaping new learning experiences.

Unlike content and pedagogical knowledge, which remain relatively stable, *technological knowledge* is constantly evolving. Teachers must not only master their subject matter but also develop a deep understanding of how technology influences and reshapes teaching practices.

Technological knowledge involves selecting the most appropriate digital tools for a given subject area, understanding how these tools affect learning processes, and adapting to continuous advancements in educational technology. For example, the integration of artificial intelligence (AI), adaptive learning platforms, and gamification techniques has transformed language

instruction by enabling personalized learning experiences.

Thus, teachers who possess strong technological knowledge are better equipped to leverage technology effectively, fostering engagement and improving learning outcomes.

To overcome the challenges of technology integration, educational institutions and policymakers must implement proactive measures that support teachers in developing technological competence. Some key strategies include:

1. Bridging the Access Gap: Ensuring that all educators have access to up-to-date technological resources and digital training programs.

2. Promoting Mindful Technology Use: Encouraging teachers to adopt technologies that enhance, rather than replace, pedagogical best practices.

3. Providing Professional Development: Offering tailored training sessions that address the specific needs of educators across different disciplines.

4. Investing in Robust Technological Infrastructure: Allocating resources to overcome the challenges of technology integration, educational institutions and policymakers must implement proactive measures that support teachers in developing technological competence. Some key strategies include:

1. Bridging the Access Gap: Ensuring that all educators have access to up-to-date technological resources and digital training programs.

2. Promoting Mindful Technology Use: Encouraging teachers to adopt technologies that enhance, rather than replace, pedagogical best practices.

3. Providing Professional Development: Offering tailored training sessions that address the specific needs of educators across different disciplines.

4. Investing in Robust Technological Infrastructure: Allocating resources to maintain and upgrade classroom technology, ensuring its long-term sustainability.

By fostering a supportive environment for technology adoption, institutions can empower teachers to integrate digital tools in ways that enhance student engagement, creativity, and critical thinking skills.

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PHILOLOGICAL SCIENCES

SIMPLE SENTENCE, ITS ACTANTS AND VARIABILITY

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Abstract

The article studies the variability of simple short sentences. Regardless of the specific language, the sentence is presented as the main means of communication. The author writes that sentences of different structures and different lengths are used in the communication process, depending on the volume of the thought used.

The article states that sentences in English are divided into two main groups according to their structure: 1) simple sentence; 2) complex sentence.

Introduction

The grammatical form of the sentence is not the same as its formal syntactic structure. The grammatical form of the sentence consists of two inseparable aspects: formal-syntactic on the one hand, and intonation on the other. "The grammatical form of a sentence is its scheme, in other words, it is the rule of general expression of thought through language. In the grammatical form of the sentence, its syntactic organization appears as the basis of the sentence - that is, its eternal property. At the same time, intonation creates countless options. This can be explained by the fact that, unlike the syntactic form, which manifests itself in the internal relationship between words and sentences in separate parts of the sentence, its intonation form has the ability to express external relations in a contextual flow along with internal relations" [Dressler 1978, p.4].

In this context, the problem arises from the conflict between the objective factor and the subjective factor. Although the intonation formation is mainly related to the objective factor, it can also be shown as a subjective evaluation, so that the subjective evaluation can be given in the framework that the possible aspects of the given syntactic structure are advanced [Zvegintsev 2007, p.4].

In modern linguistics, research on intonation reflects its participation in expressing the content of speech and in forming the content of communication by interacting with lexical-grammatical means. When we talk about the syntactic function of intonation, we should not only mean the composition of the communicative type of the sentence, turning it into a whole, but also the syntagmatic articulation of intonation, which is associated with the meaning and grammatical structure. According to L.R. Zinder, prosody performs two functions: emotional and the communicative function that opposes it. In the second sense, he understands everything that connects prosody with the meaning and syntactic structure of the sentence [Zinder 1976, p. 268].

Then he notes the main meanings of the communicative aspect of intonation:

- 1) It is a means of dividing speech into sentences;
- 2) It participates in determining the communicative types of the sentence;

3) It participates in the actual articulation of the sentence and divides it into syntagms, etc. [Zinder 1976, p. 271].

Intonation, which is the template of a sentence, is not only limited to giving a communicative unit a certain form, but also divides the thought into small units of meaning - syntagms, in order to make it understandable. However, intonation cannot act independently in isolation from the syntactic and lexical material. Its sphere of action is organically connected with the syntactic activity of the sentence. However, as noted, intonation is a phonological tool that carries a certain function in the language, actualizing the sentence for the expression of the thought.

Simple sentences and their relationship with relatively small speech units are also important conditions. Compared to other people, it is called a syntagm in our language. This term was introduced to linguistics for the first time by the Russian scientist, Academician L.V. Sherba. He considered the syntagm "the main syntactic unit in the speech process" [Shcherba 1963, p.86].

"There is a fundamental difference between a sentence and a syntagm. A sentence is composed of one or several groups of syntagms expressing a finished thought, which are normally accompanied by a lowering of the tone of voice" [Shcherba 1963, p.86].

"If the syntactic structure of a sentence is associated in the form of an elaborate form during the speech, the syntagm is considered to be an occasional event and this fact is understood only as an independent speech element. This speech element is mainly obtained by the intonation structure, the moment of intonation, which unites the syntagm, etc." [Shcherba 1974, p.5].

A simple sentence is usually studied as a unit expressing one thought. The article also touches on the division of simple sentences into two subgroups. They are: 1) Simple short sentences; 2) simple extended sentences. The article provides information about the fact that sentences consisting only of main members are simple short sentences [Musayev 1997, p. 101].

From the first moments when people began to understand themselves, they began to be interested in the material and spiritual world surrounding them, in the wonderful secrets of this world, and not only did they

begin to study it, but they also became seriously interested in language, thinking about its origin, essence, and the role it plays in society, studying it, and trying to uncover its mysterious secrets. In those times, there was neither such a science, which we know today as linguistics, about which we make various, sometimes mysterious, opinions, nor linguists who studied it; in ancient times, the science of philosophy, which stood above all sciences, or more precisely, the founders of this science, philosophers, were engaged in various problems of language. At that time, language was one of the main problems that interested philosophers, made them think, and caused constant disputes among them.

In the early days, philosophers understood only individual words under the concept of language. They thought about the question of how the various words in the language were formed, whether there was a connection between words and the things and actions they expressed, and they first tried to solve this problem. This problem caused serious controversy among philosophers.

The names of two Greek scientists are most often mentioned in this field. One of them was Democritus, known in the history of philosophy as a materialist philosopher, and the other was Heraclitus, who claimed that everything in nature originated from fire and that fire was the primary substance in nature.

According to Heraclitus and his followers, there is a natural connection between words and what they express. According to Democritus and his followers, there is no connection between words and what they express; the meanings inherent in words have arisen simply as a result of the agreement between people.

Without opening a wide polemic in this area, we would like to say that here it is necessary to agree with Heraclitus's opinion. Because nothing in language is accidental, it is a law. Most likely, all the words existing in languages have arisen in a natural connection with what they express. When people created a word, they either likened it to the thing it expresses, or associated it with the time of occurrence of an event or state, or connected it with the place where the event occurred. Sometimes, words were created taking into account people's professions (for example, blacksmith, coal miner, oilman, driver, captain, butler, etc.), etc. [Musaev 1997, p.354].

Thus, the words used in the language arose in connection with the meaning they expressed and served as a means of communication between people.

It is impossible to imagine the emergence of words in each language in any other way. In fact, the emergence of language was formed by the emergence of words used in this language. That is why in ancient times, when people spoke of language, they first of all understood the word, and that is why the word and its emergence emerged as the first historical-philosophical problem of the science of language. Even today, such a problem makes philosophers and linguists think, and they deal with this problem from time to time [Brown et al 1983, p.26].

As for Democritus's hypothesis about the origin of words, that people created words based on the agreement they reached among themselves, it is absolutely impossible to believe in this. Because in the history of the development of language, even today, no word is created on the basis of the agreement of people in any language, this is absolutely impossible. Even terms that have a basic meaning in a language are not created in this way, that is, by the agreement of someone. In connection with the development of science and technology, literature and culture, and economy, a term is created by someone, and then it enters the use of all mankind. Thus, philosophers who equated words with language began to understand over time that language does not consist only of words, but as a means of communication, language cannot do without individual words. After that, linguists, in addition to studying individual words, began to identify another linguistic unit existing in the language - word combinations and study their inherent characteristics. After some time, linguists realized that neither individual words nor word combinations formed on their basis constitute a language as a means of communication [Gazdar 1979, p.101].

They realized that in order for language to be used as a means of communication between people, there must be another unit - the sentence. Because the main condition for communication, communicability, is possible only through the sentence and allows language to function as a means of communication. Thus, the language unit that we use today as a sentence and try to study its specific features has become the object of study of grammar (syntax).

In modern times, the science of linguistics has gone a little further and discovered the existence of another language unit that is important for communication - the text.

Thus, the development direction of the study of the grammatical structure of language can be shown approximately as follows:

A sentence is used in the process of communication and serves its creation. Communication is a multifaceted and complex process. In order to create communication, people have to express ideas with different purposes; they either provide information about this or that fact, or ask about it, or encourage the interlocutor to do something, or simply express their feelings and emotions in response to the influence they receive from the world around them. On the other hand, sentences have different lengths and different contents, depending on the idea they have to express [Bloomfield 1933, p.65].

Sentences used in the process of communication vary in terms of the purpose of expressing the idea and also in terms of their grammatical structure. Accordingly, sentences are usually classified and divided into types according to their purpose in communication and the structure they have.

Variability characterizes the general property of the language system as being realized in speech in the form of many variants. A variant is a specific realization of a linguistic unit, while variability is understood as the process of using variants and manifests itself at

all levels of the language. The concept of variability applies both to the language as a whole and to its various forms - oral and written, codified and dialect, territorial and social. This gives grounds to say that the manifestation in the form of variability and variants has a universal character [Lyons 1968, p.56].

The problem of variation has been explained in different ways in many languages at different times and is still being explained from different points of view not only in the linguistics of different peoples, but also in any national linguistics, and even in the works of specialists of the same language, and different representatives of the same linguistics. It is known that the concepts of "invariant" and "variant" entered linguistics from phonology.

When we talk about the components of the universal language in linguistics, we mean its two branches: 1) literary speech, or literary language; 2) non-literary speech, or colloquial language). This division is conditional as these branches of the universal spoken language do not operate in isolation from each other, but are in parallel and dynamic development.

The differentiation of language variability, its formation on the basis of certain norms, is for the purpose of ensuring the semantic disclosure of thought at the necessary level. In this regard, the phenomenon of variability in any language manifests itself in various forms. Therefore, in the semantic meaning and disclosure of thought, phonemes, sounds, stress, conjunctions and adverbs, complex sentences, mixed-type sentences, in short, certain language components, as well as the specific role of invariance and variation, have an important function. Recently, a number of studies have been conducted in the world, including Azerbaijani linguistics, on the problem of variability.

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POLITICAL SCIENCES

STRATEGIC GOALS IN HEYDAR ALIYEV'S EDUCATION POLICY: FORMATION OF NATIONAL PERSONNEL

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Abstract

The article analyzes the science and education policy implemented by Heydar Aliyev during the Soviet period and the years of independence, and the concept of education, which he founded. In accordance with the set goal, issues such as the priority of education in the Soviet era and the strengthening of national personnel potential, education policy and its integration into the world education system during the period of independence, the concept of education and its positive results were studied and analyzed. The main focus is on the role played by Heydar Aliyev in the development of national education, training of national personnel, the opening of military lyceum, secondary and higher schools, the sending of Azerbaijani youth to the most prestigious universities in the world, and its positive results for current education.

Keywords: Heydar Aliyev, science and education policy, national education, training of military personnel, Education Concept of independent Azerbaijan.

Introduction

Society is a synthesis of personalities and society, society members. A person who can lead the community becomes a great personality and becomes the author of ideas and the driving force of the processes. However, even the most beautiful, progressive idea in itself is not enough for social progress. The realization of the idea is the main condition. In order for the society to move towards the social ideal, it is enough to achieve the society's confidence in the personality and the leader. Again, the main task falls on the personality. The bitter tragedy of abandonment or loneliness awaits those who cannot gain or justify their faith. Thus, it can be said with complete certainty that it is the personalities that develop the society. [Musayev, 2023].

From this point of view, the development of the field of education was one of the priority directions in the strategy of the great leader Heydar Aliyev aimed at the future of the people of Azerbaijan. The reforms carried out in this direction covered all levels of education and the material and technical base. The educational reforms carried out in Azerbaijan under the leadership of Heydar Aliyev since the 70s of the last century constitute a special stage in the development of this field. Educational reforms carried out during the first period of Heydar Aliyev's leadership in Azerbaijan laid the foundation for the development of this field. As a result of the implementation of the decisions adopted in 1972 "On completing the transition of young people to general secondary education and further developing the general education school" and in 1973 "On further improving the working conditions of rural general education schools", the network of secondary schools in the republic was expanded, fundamentally

qualitative change was achieved. Also, the problem of providing schools with textbooks was solved, and starting from 1978, textbooks were given to students free of charge [AZERTAC, 2022].

In the educational policy of the genius leader, further improvement of the activity of higher schools and strengthening of their material and technical base had a special place. On November 1, 1969, Heydar Aliyev, who participated in the solemn meeting dedicated to the 50th anniversary of Baku State University, spoke about the tasks ahead in the field of higher education in his speech in his native language. This was a turning point in the direction of the awakening of the national spirit not only for the university staff, but for the entire Azerbaijani society.

One of the main issues that concerned Heydar Aliyev was the preparation of Azerbaijani youth for the army and their involvement in military schools. As a result of his initiative and foresight, a military-oriented school named after Jamshid Nakhchivanski was established in 1971.

1. Prioritization of education and strengthening of national personnel potential in the Soviet era

The statesman who prepared the ground for the future independence of Azerbaijan in 1969-1982 did great work in the direction of its revival by preventing the suppression of the national spirit and Azerbaijaniness within the framework of the Soviet ideology. The Great Leader skillfully used the available opportunities and said that life is a big process. In order to successfully participate in this process, a person must have an education in accordance with modern requirements.

"The field of education is the most important field for the future of our people, our nation, our state", - the decisions taken by the Great Leader, who always highly appreciates the role of education in the development of society and its importance in the formation of personality, conceptual ideas and ideas put forward with foresight, and historical recommendations are still valid today. contributes to defining the main directions of educational reforms in our country. The wise leader, who did great work for the development of Azerbaijani education, did not look at education only as an opportunity to gain knowledge and learn science, he always emphasized that education has an important role in the formation of an active citizen's position and close participation in the process of progress in society [Karimzadeh, 2019].

The national leader was well aware of how important this issue is for Azerbaijan to be recognized among countries and states, and to gain prestige. That is why he attached great importance to the youth's higher education, education, and acquisition of fundamental and humanitarian sciences. At the same time, he kept in mind the solution of the problems hindering the progress of science and education, and in this direction, he set the important task of strengthening the intellectual resources of the republic and strengthening the educational infrastructure. The construction and modernization of new buildings for schools, higher and secondary specialized institutions on a large scale, the implementation of certain projects for the purpose of training qualified personnel was a clear expression of this [Bagirov, 2022].

July 14, 1969, which is the turning stage of modern Azerbaijan, entered our national history as the beginning of a great era led by Heydar Aliyev, and the historical stage that started from that year is valued as the renaissance period of Azerbaijani education, science and culture. From the very first day, the genius personality who defied all the ideological and political barriers of the Soviet regime and led the society to progress in all directions, considered it an extremely important factor for the strengthening of the national ideology in the society and the re-formation of the consciousness of statehood for every Azerbaijani to receive a higher education and master scientific innovations. Under the leadership of the Great Leader, successive measures were taken in the direction of the nationalization of education, the development of our language, and the preservation of the historical nature of social sciences.

In that period, all educational institutions in Azerbaijan rose to a new level of development compared to previous years, and the consistent state policy in this direction played an exceptional role in raising the educational, general cultural and intellectual level of the population of Azerbaijan [Bayramov, 2019].

In that period, special attention to the development of education was also shown in school construction. In 1979, the number of secondary schools more than tripled to 2117 compared to 1965, and in 1982 it reached 4267. The number of students increased from 368 thousand in 1970 to 710 thousand in 1980. In 1970-

1980, 1191 new school buildings with a capacity of 683.1 thousand students were built and put into use in the republic, which was twice as much as the corresponding indicator in 1946-1970.

During the first period of Heydar Aliyev's leadership in Azerbaijan, the number of vocational schools increased by 1.7 times compared to 1965, and the number of students increased by 2.5 times. On his initiative, a strategy for the improvement and development of technical vocational education was determined for the years 1971-1975, 54 new technical vocational education institutions started to operate.

Emphasizing the important role of the university in the life of the Azerbaijani people and in the development of Azerbaijani science, Heydar Aliyev said: "In 1919, when the issue of opening a university was discussed in the public circles of Azerbaijan, some doubted and said that this work would not be done. It is better to educate young people in well-known university centers of foreign countries. send to buy. Today, we can tell those unbelievers that ambassadors from four continents are coming to Azerbaijan to study" [AZERTAC, 2022].

In 1969-1982, when national leader Heydar Aliyev led Azerbaijan, five new higher education institutions were opened and the number of higher education students increased from 70,000 to 100,000. If at the end of the 1960s, there were 105 faculties and 450 departments in 12 higher schools in the republic and personnel training was being conducted in 139 specialties, in 1982 there were already 21 higher education institutions combining 136 faculties and 530 departments.

One of the exceptional services of Heydar Aliyev in the development of education in Azerbaijan is the creation of national personnel potential, including a contingent of specialists in rare specialties. For this purpose, he created conditions for more than 15,000 Azerbaijani youths to study in more than 170 prestigious higher schools of more than 50 major cities of the former USSR outside of Azerbaijan, and in the future, more than 80 areas of our republic's economy, science, education and culture. , made a great contribution to meeting the need for highly qualified personnel in more than 250 specialties [Aliyev, 2023].

In 1982-1987, when Heydar Aliyev was the first deputy chairman of the Council of Ministers of the USSR, he created conditions for the youth of Azerbaijan to study outside the borders of the republic. He often met with Azerbaijani students and used all opportunities to solve their problems. He appreciated them as "children of Azerbaijan, national wealth of Azerbaijan".

Hundreds of Azerbaijani citizens began to study at the Jamshid Nakhchivanski military-oriented high school created as a result of his initiative. The Great Leader had great respect for those who devoted their lives to military art and the profession of officers and always appreciated their services. The formation of modern professional officer cadres, without a doubt, actualized the level of organization of education in military educational institutions of the country. The development of the institutional foundations of the

education system, the expansion of the application of innovative training methods and technologies, the creation of a competency-based personality and result-oriented education model have been set as a strategic goal. Based on this principle, we can say that the steps taken at that time are bearing fruit today [Huseynov, 2022: 25].

That is, Jamshid Nakhchivanski Military Lyceum had an exceptional role in the training of national officers and in the formation of our Armed Forces. Today, most of the officers serving in the ranks of our army are graduates of Jamshid Nakhchivanski Military High School. They showed great skill and bravery in the battles for the freedom of our lands.

At the same time, not only within the country, but also in the 70s and 80s of the last century, under the leadership of Heydar Aliyev, the creation of a wide network of educational institutions and the formation of a rich material and technical base of that network, the sending of Azerbaijani youth to study at universities outside the borders of the republic, the training of military personnel, ensuring the development of fundamental science in the research institutes of the Republican Academy of Sciences created the necessary intellectual ground for national independence in the future [AZERTAC, 2022].

2. Education policy in the period of independence and integration into the world education system

Since coming to power, i.e., starting from 1993, one of the priority areas that the state gave importance to was the education policy. Heydar Aliyev, who returned to the leadership in a very difficult situation of the republic, besides solving many problems, began to implement reforms in the field of education in accordance with the requirements of the time. In 1991-1993, the disturbed activity of educational institutions was brought to a normal state, and the basis of planned reforms was laid. The number of secondary schools and the number of students increased substantially. If in 1993-1994 academic year 1 million 549 thousand students studied in 4364 general education schools of the republic, in 2002-2003 academic year more than 1 million 600 thousand teenagers continued their education in 4561 general education schools.

In addition, the material and technical base of the education system was improved, 200 new school buildings were built and put into use, and more than 700 general education schools were established in the regions and cities where IDPs temporarily live. About 30 lyceums and gymnasiums were organized in order to develop the abilities of talented children, and about 12 thousand students were involved here.

"After deeply studying the current state of our education system and its problems, priority areas should be determined," said the Great Leader, who has done important work in Azerbaijan for the implementation of an education strategy in accordance with the experience of developed countries of the world. On March 30, 1998, the State Commission for Education Reforms was established by the President's Decree, "Education Reform Program of the Republic of Azerbaijan" was prepared and approved on June 15,

1999. [URL, 1999]. In the program, by determining the future development strategy of education, fundamental reforms were planned in the structure, management, content, material and technical base, economy, personnel training and provision of the education system.

"On improving the education system of the Republic of Azerbaijan" June 13, 2000, "On improving the implementation of the state language" June 18, 2001, "On establishing the Azerbaijan Alphabet and Azerbaijani Language Day" August 9, 2001, "Azerbaijan Decrees dated January 2, 2003 "On the implementation of the Law on the state language in the Republic of Azerbaijan" [President of the Republic of Azerbaijan, 2024]. played a big role in raising our education to world standards. At the same time, attention was paid to the teaching of Azerbaijani history, literature, geography, the preparation of excellent textbooks, the teaching of the Azerbaijani language, especially its promotion as a state language.

The reforms did not cover only educational institutions, fundamental work was also done to encourage young people to study. The Decree dated September 3, 2001 on establishing the Presidential scholarship for higher school students is a clear example of this.

Reconstruction and improvement of the education system in the Republic of Azerbaijan on the basis of national and universal values has always been at the center of the state policy as a priority direction in the activities of the Great Leader Heydar Aliyev. As a result of his concept of Education, the modern education policy of Azerbaijan was carried out in accordance with the global educational challenges, the values and practices accepted by the majority of the civilized world without denying the nationwide, historical and moral factors, the progressive experiences of the previous years.

3. Heydar Aliyev's concept of education and its positive results

Heydar Aliyev, who is deeply familiar with education, all its fields and problems, made decisions in the direction of raising worthy, educated, patriotic citizens of Azerbaijan, based on the concept of Education, which he authored, from 1993, taking into account national and universal values, and created the legal basis for reforms. Thus, in Article 42 of the Constitution of the Republic of Azerbaijan, which was adopted on November 12, 1995, the right to education was established [URL, 1993].

In 1996, at the initiative of the Great Leader, "On Accession to the Convention of December 21, 1979 on the Recognition of Study Courses, Diplomas and Scientific Degrees in the States of the European Region", as well as in 1997 "On the Recognition of Higher Education Specializations (Qualifications) in the European Region) laws were adopted on the approval of the Convention on Recognition. This was a preparation for the gradual integration of the Azerbaijani national education system into the European educational space based on historical traditions and achievements [Aliyev, 2023].

On March 30, 1998, the State Commission for Education Reforms was established by the Decree of the head of the country. The commission was supposed to prepare the Education Reform Program in the country based on Heydar Aliyev's conceptual recommendations. The Reform Program envisages creating the education system to meet the global challenges of the 21st century, the stability and sustainability of economic development, as well as the requirements of the European labor market and ensuring access to it. On June 15, 1999 – National Liberation Day, he approved the Education Reform Program by special order [URL, 1999] and defined the main goal of the reforms. As the Great Leader Heydar Aliyev said, "using the past traditions, achievements, and great potential in the education system of Azerbaijan, the work of adapting the education system to new requirements and implementing reforms has begun, and these are also giving their positive results" [Hasanov, 2020].

This reform program, consisting of three stages, was the largest State Program in terms of duration, scope and scale.

As a result of the implementation of the "Educational innovative stage", which is the stage of the National Leader Heydar Aliyev's Education Concept in the period 1999-2003, the quality indicators of education at all stages and levels have increased, and the long-term, dynamic development of Azerbaijani education and its material and technical base has been ensured. Adapting the Education Concept of the Great Leader to modern global contexts, President of Azerbaijan Ilham Aliyev put forward the concept of creating human capital in order to create a new education system, including a new higher education system in the new era. New state programs related to the development of education were approved. Our national education, which provides 100 percent literacy in Azerbaijan, successfully completed its new stages: "Preparation stage" in 2004-2007, and "Implementation stage" in 2008-2013.

By having such a sensitive attitude towards the development of science and education, the great leader determined the basis of Azerbaijan's progress by paying serious attention, and this also came from the conclusion of the genius that the development of the country is related to the high education and enlightenment of people. At the same time, the national leader carried out the strengthening of the economy of our republic in parallel with the development of science and education. In other words, the path of economic development was through science and education, and Azerbaijan gained recognition and prestige in the world [Bağırov, 2022].

In our modern era, it is an undeniable fact that human capital constitutes an important part of the national wealth of every country. "Azerbaijan 2020: a vision of the future" Development Concept of the political successor of the Great Leader, President Ilham Aliyev [Azerbaijan, 2020].

"State Strategy for the Development of Education in the Republic of Azerbaijan", "Strategic Roadmap for the Perspective of the National Economy of the

Republic of Azerbaijan" each reflects the development priorities of human capital based on knowledge and innovation. In Azerbaijan, effective and consistent work is being done to ensure the sustainable development of human capital, to adapt education and qualified personnel training to the modern requirements of the labor market. In modern times, innovations and technologies play an important role in the sustainable economic development and productivity growth of any country. Strengthening the connection of science and education with the economy in Azerbaijan was also reflected in the "National Strategy for the Development of Science in the Republic of Azerbaijan in 2009-2015" approved by the decree of the President of the Republic of Azerbaijan dated May 4, 2009. In the "State Program on Reforms in the Higher Education System of the Republic of Azerbaijan in 2009-2013" approved by the President of the Republic of Azerbaijan, it is noted that the progress of the society has always depended on the development of education and the correct assessment of its importance, the current demand has accelerated the development of education, scientific and technological achievements have placed more complex tasks before the educational system, which must be solved. The same document also states that the UN has declared the 21st century as the "century of education". From this point of view, the role of higher education in the formation of highly intelligent human capital and the establishment of a strong economy that creates a foundation for sustainable development is undeniable.

The "Azerbaijan 2020: Vision of the Future" development concept states that the transition from the traditional economy to the knowledge economy should be laid now, and the adequate development of human capital, which is decisive for this, should be prioritized. The urban environment prepares a good basis for the development of human capital and the establishment of a knowledge economy [Azerbaijan, 2020].

In accordance with the current concept of the development of modern higher education and its integration into the world, ADA University, Baku Higher Oil School, which meets the most modern requirements and has become a national brand, was established in Azerbaijan. Baku branches of Moscow State University named after M.V. Lomonosov and First Moscow State Medical University named after I.M. Sechenov were established. The Azerbaijan-French University (UFAZ) has started its activities in order to create an opportunity for the citizens of the Republic of Azerbaijan to receive quality education within the framework of higher education standards of leading countries without going abroad. Here, teaching in 4 majors (chemical engineering, computer science, geophysical engineering, oil and gas exploration and exploitation) has been started in English, and it is planned to issue a double diploma with the French universities of Strasbourg and Rennes 1. In recent years, the most modern campuses have been created for a number of higher education institutions, and the material, technical and educational base of all higher education institutions has been significantly updated.

Important decisions were taken by the head of state in the field of increasing the accessibility of higher

education, improving the social protection of students, training highly qualified and professional personnel in the country, and forming a competitive environment in higher education. According to the decree of the President of the country, the scholarship system has been improved, the number of scholarship places funded by the state has been increased by 16 thousand units from March 1 of the current year, and the number of students receiving scholarships is planned to be increased to 50 percent in the next two years. In addition, the amount of scholarships given to students was increased by an average of 20 percent, these measures covered more than 110 thousand students. At the same time, state-ordered places for the undergraduate level of higher education institutions were increased by 66 percent, from 27 percent to 42 percent of last year's admission plan [Bayramov, 2019].

Conclusion

The wide network of pre-school, general, vocational, secondary specialized and higher education institutions operating in our country today, and the strong scientific and pedagogical staff potential have their source precisely from the purposeful policy in the field of education carried out under the leadership of Heydar Aliyev since the 70s of the last century, and the large-scale education implemented construction has created a strong foundation for future development.

It can be concluded that the current development of our current science and education is being continued by the head of the country, Mr. İlham Aliyev, according to the concept and system established by Heydar Aliyev. From this point of view, the integration of Azerbaijani science and education into the world, the formation of modern young personnel is a clear example of the foundation laid many years ago and the continuing education policy.

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PSYCHOLOGICAL SCIENCES

REAL CASES OF SUCCESSES AND CHALLENGES IN THE WORK OF MIXED SHIP CREWS

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РЕАЛЬНІ КЕЙСИ УСПІХІВ ТА ВИКЛИКІВ У РОБОТІ ЗМІШАНИХ ЕКІПАЖІВ СУДЕН

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Abstract

The globalization of the maritime industry has led to the widespread use of mixed crews on ships. Mixed crews consist of members from different nationalities, cultures, and language groups, creating both unique opportunities and significant challenges. This article examines real-life cases that highlight successes related to increased work efficiency, the implementation of innovative solutions, and improved team interaction, as well as challenges such as language barriers, cultural differences, and psychological stress. The analysis of these cases provides insights into how diversity impacts safety, productivity, and team dynamics. Furthermore, practical strategies are identified to overcome cultural and communication barriers, including the introduction of intercultural training, standardized communication protocols, and leadership development. This approach can contribute to improving crew working conditions and the overall efficiency of the maritime industry.

Анотація

Глобалізація морської галузі призвела до широкого використання змішаних екіпажів на судах. Змішані екіпажі складаються з членів різних національностей, культур та мовних груп, що створює як унікальні можливості, так і значні виклики. У статті розглядаються реальні кейси, які висвітлюють успіхи, пов'язані з підвищенням ефективності роботи, впровадженням інноваційних рішень і покращенням командної взаємодії, а також виклики, зокрема мовні бар'єри, культурні відмінності та психологічний стрес. Аналіз цих кейсів дозволяє зрозуміти, як різноманітність впливає на безпеку, продуктивність та командну взаємодію. Крім того, визначено практичні стратегії, які допомагають подолати культурні та комунікаційні бар'єри, зокрема впровадження міжкультурного навчання, стандартизованих комунікаційних протоколів і розвиток лідерства. Цей підхід може сприяти покращенню умов праці екіпажів і загальній ефективності судноплавної галузі.

Keywords: mixed crews, globalization, intercultural communication, language barriers, cultural differences, team interaction, safety, productivity, psychological stress, leadership, maritime industry.

Ключові слова: змішані екіпажі, глобалізація, міжкультурна комунікація, мовні бар'єри, культурні відмінності, командна взаємодія, безпека, продуктивність, психологічний стрес, лідерство, судноплавна галузь.

Морська галузь функціонує у глобалізованому середовищі, що робить змішані екіпажі звичним явищем на сучасних судах. Змішані екіпажі, до складу яких входять представники різних національностей, культур та мовних груп, мають як унікальні переваги, так і виклики. Розуміння цих динамік є важливим для підвищення ефективності та безпеки морських операцій.

Змішані екіпажі сприяють створенню багатокультурного робочого середовища, яке може позитивно вплинути на виконання завдань. Різноманітність культурних підходів до вирішення проблем сприяє генеруванню інноваційних рішень і більш ефективному використанню ресурсів. Крім того, члени екіпажу з різними професійними та освітніми підходами можуть обмінюватися досвідом, що сприяє підвищенню кваліфікації всього колективу. У багатьох випадках це дозволяє швидше реагувати на складні ситуації, такі як

аварії, несправності обладнання або небезпечні погодні умови.

Однак різноманітність також створює значні виклики. Одним із найпоширеніших бар'єрів є комунікація. Навіть у випадках, коли всі члени екіпажу володіють англійською мовою, яка є міжнародним стандартом у судноплаванні, рівень володіння мовою може суттєво відрізнятися. Це може призводити до неправильного розуміння інструкцій, особливо в умовах стресу або під час надзвичайних ситуацій. Відомі випадки, коли такі мовні бар'єри ставали причиною аварій або затримок у роботі судна.

Культурні відмінності також можуть впливати на взаємодію в команді. Наприклад, представники різних культур можуть мати різне ставлення до ієрархії, відповідальності та способів вирішення конфліктів. У деяких культурах прийнято прямолінійно висловлювати свою думку, тоді як в інших переважає більш дипломатичний підхід. Це

може викликати непорозуміння, що впливає на ефективність командної роботи.

Не менш важливим викликом є психологічний стрес, який виникає через ізоляцію, тривалий час перебування в морі та необхідність адаптації до багатокультурного середовища. Члени екіпажу можуть відчувати себе відчуженими, особливо якщо їхня культура або рідна мова не поширені серед колективу. Це може впливати на їхню мотивацію, продуктивність і загальний психологічний стан.

Для подолання цих викликів необхідно впроваджувати систематичні підходи до управління змішаними екіпажами. Одним із ключових аспектів є міжкультурне навчання, яке допомагає членам екіпажу краще розуміти цінності, традиції та поведінкові моделі своїх колег. Регулярні тренінги з комунікації, де використовується стандартизована морська англійська, також можуть зменшити ризик непорозумінь.

Крім того, важливу роль відіграє лідерство. Капітан та старші офіцери, які володіють навичками міжкультурного управління, можуть ефективніше вирішувати конфлікти, мотивувати екіпаж і створювати сприятливу атмосферу на борту. Успішні кейси свідчать про те, що капітани, які демонструють відкритість до культурного різноманіття та вміння знайти індивідуальний підхід до кожного члена екіпажу, досягають кращих результатів у роботі команди.

Загалом, змішані екіпажі є невід'ємною частиною сучасної морської галузі. Їхній успіх залежить від здатності судноплавних компаній та командного керівництва адаптуватися до умов багатокультурного середовища, зберігаючи баланс між використанням переваг різноманітності та мінімізацією її викликів. Розуміння цих процесів є ключовим для забезпечення безпеки, ефективності та добробуту в морському середовищі.

Далі опишемо ситуацію, яку можна порівняти з реальними випадками, коли багатонаціональні екіпажі стикаються з технічними проблемами в морській індустрії. Наприклад, подібні ситуації можуть бути характерні для великих контейнеровозів, таких як «Ever Given» або «MSC Zoe», які мають міжнародні екіпажі з різних країн. У випадку з «Ever Given», хоча інцидент був пов'язаний з застряганням в Суецькому каналі, подібні багатонаціональні команди працюють в умовах високої напруги і необхідності швидких рішень у випадку технічних несправностей, таких як поломка двигуна.

Крім того, з огляду на масштаби інциденту, такі судна, як «Maersk Triple-E» або «HMM Algesiras», часто мають багатонаціональні екіпажі, що складаються з фахівців різних культур і професійних підходів. Вони можуть застосовувати різні стратегії для вирішення технічних проблем, враховуючи як традиційні методи, так і інноваційні технології, щоб швидко та ефективно усунути несправності і мінімізувати час простою судна.

Таким чином, цей приклад можна розглядати як узагальнення реальних ситуацій, що стосуються

багатонаціональних екіпажів великих контейнеровозів, і він ілюструє, як культурні та технічні особливості можуть впливати на процеси вирішення надзвичайних ситуацій на борту.

Кейс багатонаціонального екіпажу контейнеровоза, який зіткнувся з критичним виходом з ладу двигуна, є яскравим прикладом того, як культурні різниці можуть стати основою для інноваційних рішень у складних ситуаціях. В цьому випадку різноманіття досвідів та підходів членів екіпажу з різних країн дозволило розробити стратегію, яка не лише вирішила технічну проблему, а й значно зменшила час простою судна, що є критично важливим у транспортній галузі.

Під час інциденту, коли двигун контейнеровоза вийшов з ладу в океанських водах, екіпаж зібрався для обговорення способів оперативного ремонту. Члени екіпажу представляли різні культури, включаючи представників країн Азії, Європи та Південної Америки. Кожен з них мав власний підхід до вирішення проблем і своє бачення стратегії ремонту. Це дозволило збалансувати різні технічні, організаційні та культурні аспекти.

Наприклад, члени екіпажу з Європи запропонували використовувати традиційні методи і інструменти для ремонту, оскільки вони мали досвід роботи з подібними ситуаціями у своїх регіонах. Водночас представники з Азії внесли ідею використання новітніх технологій, таких як дистанційний моніторинг системи та використання спеціальних мобільних додатків для управління ремонтом. Ці інноваційні методи дозволили зібрати всю необхідну інформацію про стан двигуна в реальному часі, що зробило процес ремонту більш ефективним.

Крім того, культурні відмінності проявилися в організаційних моментах. Наприклад, члени екіпажу з Латинської Америки підкреслювали важливість командної роботи та взаємної підтримки у критичних ситуаціях, в той час як представники з Європи акцентували на чітко визначених ролях і функціях кожного члена екіпажу для забезпечення злагодженого виконання завдань. Це дозволило не лише оперативно вирішити технічну проблему, але й підтримати психологічний клімат на борту, що мало важливе значення для запобігання стресу і паніці.

Крім того, було враховано й інші культурні аспекти, такі як способи комунікації та сприйняття часу. Деякі члени екіпажу, що походили з країн з високим рівнем технологічного розвитку, були більш схильні до використання науково обґрунтованих підходів, тоді як члени екіпажу з країн, де традиції і досвід мають більшу вагу, більше зосереджувалися на реальних практичних рішеннях. Це забезпечило інтеграцію різних підходів до технічного та організаційного вирішення проблеми.

Насамкінець, інноваційний підхід, зумовлений багатонаціональним складом екіпажу, став основою для успішного ремонту двигуна і мінімізації часу простою судна. Взаємодія різних культурних та технічних підходів дозволила створити високоефективну стратегію, що в результаті забезпечила не

лише технічний успіх, але й покращила моральний клімат на борту. Цей випадок підкреслює важливість культурної різноманітності в командній роботі та її здатність стимулювати інновації в процесах вирішення складних проблем.

Змішані екіпажі, складаючись із членів з різних культурних, професійних і мовних середовищ, часто виявляють надзвичайну здатність адаптуватися до змінних і стресових обставин. В умовах сильного шторму, коли кожна хвилина має вирішальне значення, особлива увага приділяється координації та ефективному управлінню кризовою ситуацією. Співпраця між членами екіпажу з різних культур дозволяє поєднати різноманітні підходи до вирішення проблем, що є важливим для забезпечення безпеки судна, екіпажу та вантажу.

Наприклад, члени екіпажу, які походять з країн з різними традиціями та досвідом, можуть використовувати різні стратегії для управління стресом. Ті, хто має досвід у високий ризикованих ситуаціях, можуть передавати знання про методи психологічної підтримки та стратегії прийняття рішень під тиском. Водночас, інші члени екіпажу, що мають досвід у навігації та управлінні технічними системами, можуть впроваджувати інноваційні підходи, наприклад, за допомогою нових технологій моніторингу або дистанційного керування.

Крім того, культурні відмінності можуть допомогти у встановленні більш ефективної комунікації, оскільки кожна група може бути більш чутлива до певних аспектів кризи. Це дозволяє мінімізувати непорозуміння та забезпечити своєчасне реагування на кожен виклик. Спільна робота в умовах екстремальних погодних явищ демонструє, як різноманітність досвідів може стати основою для покращеної роботи команди та швидкого реагування на кризу.

Змішані екіпажі створюють унікальні можливості для особистісного та професійного зростання завдяки культурному обміну та розвитку різноманітних навичок. Коли члени екіпажу з різних країн і культур взаємодіють у процесі роботи та навчання, вони не тільки набувають нових професійних знань, але й розвивають міжкультурне розуміння, що є ключовим для ефективної командної роботи.

Наприклад, екіпаж одного балкера повідомив про значне покращення технічних навичок після участі у спільних тренінгах, що включали як теоретичні, так і практичні заняття. Ці тренінги дозволили членам екіпажу з різних країн обмінюватися досвідом і навчатися новим методам роботи, що стосуються як експлуатації технічних систем судна, так і реагування на надзвичайні ситуації. Учасники тренінгів мали можливість адаптувати свої знання до технологій і методів, що використовуються в інших країнах, що зробило їх більш універсальними професіоналами.

Крім того, спільні командні заходи, такі як симуляції кризових ситуацій або вправи на побудову командної взаємодії, сприяли розвитку міжкультурних комунікаційних навичок, що дозволило знизити ймовірність конфліктів і непорозуміння на

борту. У результаті, члени екіпажу не тільки покращили свої технічні навички, а й стали більш відкритими до культурних відмінностей, що сприяло створенню більш згуртованої і ефективної команди, здатної ефективно діяти в будь-яких обставинах.

Ітак, які ж виклики в роботі змішаних екіпажів можна визначити?

1. Мовні бар'єри. Мовний бар'єр є однією з найбільших проблем, з якими стикаються змішані екіпажі. На великих суднах, що плавають під різними прапорами і мають міжнародні екіпажі, мовні розбіжності можуть призводити до серйозних комунікаційних проблем. Це особливо небезпечно у випадках, коли йдеться про критичні інструкції, пов'язані з безпекою. Наприклад, на танкері під час вантажних операцій екіпаж з різних країн неправильно зрозумів важливі вказівки з безпеки, що мало не призвело до аварії. Невірне тлумачення термінів або відсутність чіткої комунікації можуть спричинити серйозні наслідки, включаючи нещасні випадки, пошкодження вантажу чи навіть екологічні катастрофи. Для вирішення цієї проблеми важливо впроваджувати стандартизовану термінологію та постійно тренувати екіпаж у навичках ефективної комунікації, а також використовувати технічні засоби для перевірки розуміння інструкцій.

2. Культурні відмінності. Культурні відмінності часто стають причиною непорозуміння на борту змішаних екіпажів. Вони можуть проявлятися в різних підходах до роботи, поглядах на ієрархію, способах прийняття рішень і розв'язання конфліктів. Наприклад, в деяких культурах акцент робиться на суворій ієрархії та повазі до старших, в той час як в інших країнах переважає більш демократичний підхід до управління. Це може призвести до конфліктів або затримок у виконанні завдань, особливо коли члени екіпажу мають різні погляди на те, хто має приймати рішення і яким чином вони мають бути виконані.

Одним з прикладів є ситуація в порту, коли змішаний екіпаж зазнав затримок через розбіжності у розподілі завдань. Члени екіпажу з країн, де традиційно високий рівень поваги до авторитету, очікували, що старші офіцери будуть брати на себе більшу частину управлінських рішень, тоді як члени екіпажу з демократичних країн прагнули розподіляти обов'язки рівномірно серед усіх. Це призвело до нерозуміння і затримок, оскільки не було чітко встановлено, хто і коли має брати на себе відповідальність за певні завдання.

3. Психологічний стрес. Психологічний стрес може бути ще однією серйозною проблемою для змішаних екіпажів. Члени екіпажу, особливо в умовах тривалих рейсів, можуть відчувати ізоляцію через культурні або мовні відмінності, що негативно впливає на їхнє психічне здоров'я та загальний моральний клімат на борту. Наприклад, на пасажирському судні дослідження показало, що деякі члени екіпажу відчували себе ізольованими від інших через мовні бар'єри або незнання культурних особли-

востей колег. Це призводило до почуття виключення і знижувало ефективність комунікації між членами екіпажу.

Для подолання психологічного стресу та ізоляції важливо створити підтримуючу атмосферу на борту, де кожен член екіпажу відчуватиме себе частиною команди. Це може включати регулярні психологічні тренінги, підтримку ментального здоров'я, а також створення комфортних умов для неформального спілкування між членами екіпажу. Наприклад, організація спільних культурних заходів або тренінгів з розвитку міжкультурної комунікації може допомогти зменшити напруженість і покращити моральний клімат на борту.

Крім того, важливо надавати підтримку членам екіпажу, які можуть переживати стрес через культурні чи мовні бар'єри. Психологи або спеціалісти з управління стресом можуть проводити індивідуальні консультації, а також групові заняття, спрямовані на зниження рівня стресу та покращення загального емоційного стану.

Для ефективної роботи змішаних екіпажів необхідно регулярно проводити тренінги з міжкультурної комунікації, що дозволяє членам екіпажу краще розуміти один одного та адаптуватися до різних стилів роботи. Важливо також забезпечити ясну і чітку комунікацію на всіх етапах роботи, особливо коли йдеться про безпеку та критичні операції. Створення політики підтримки психічного здоров'я та підтримки командного духу також є важливим компонентом для забезпечення стабільності і ефективності роботи змішаних екіпажів на борту судна.

Згідно вищесказаного, можна виділити кращі практики для управління змішаними екіпажами.

1. Міжкультурне навчання. Міжкультурне навчання є важливим інструментом для зменшення бар'єрів між членами екіпажу, що належать до різних культур. Регулярні програми навчання, спрямовані на підвищення обізнаності про різні культури та розвиток комунікаційних навичок, можуть значно покращити атмосферу на борту і знизити рівень конфліктів. Програми міжкультурного навчання включають навчання щодо мовних особливостей, звичаїв та традицій різних країн, а також адаптації до нових умов. Це дозволяє членам екіпажу краще розуміти один одного, знижує ризик непорозуміння і допомагає створити більш гармонійну і продуктивну команду. Успішний приклад включає судноплавну компанію, яка запровадила обов'язкові тренінги з міжкультурної комунікації для своїх екіпажів. Завдяки цим тренінгам компанія змогла значно зменшити кількість конфліктів і покращити командну роботу. Крім того, члени екіпажу стали більш відкритими до культурних відмінностей, що позитивно позначилося на ефективності роботи та зменшило рівень стресу серед співробітників.

2. Стандартизовані комунікаційні протоколи. Впровадження стандартизованої морської англійської мови та чітких комунікаційних протоколів є важливою практикою для покращення ефективності роботи змішаних екіпажів. Морська

англійська є міжнародним стандартом у судноплаванні, і її використання дозволяє забезпечити чітке і зрозуміле спілкування між членами екіпажу, незалежно від їхнього рідного мовного середовища. Використання цієї мови в поєднанні з чіткими комунікаційними протоколами дозволяє уникати непорозуміння, особливо в критичних ситуаціях, таких як аварії чи термінові операції. Кейс на круїзному лайнері показав, що впровадження стандартизованих протоколів комунікації значно зменшило кількість непорозуміння під час аварійних навчань і реальних інцидентів. Зокрема, чітке визначення термінів, правил і процедур дозволило членам екіпажу швидко і ефективно реагувати на надзвичайні ситуації, що є критично важливим для безпеки пасажирів і судна в цілому.

3. Лідерство та медіація. Ефективне лідерство є основою успішного управління змішаними екіпажами, оскільки капітани та офіцери повинні бути здатними розв'язувати конфлікти, адаптуватися до різних культурних підходів та координувати роботу різноманітних команд. Лідери, які навчені медіації та вирішенню конфліктів, можуть значно покращити командну динаміку та сприяти ефективному виконанню завдань. На балкерах з різноманітними екіпажами, де члени команди можуть мати різні підходи до роботи, лідерство і здатність до медіації стають критичними для забезпечення гармонії та продуктивності. Капітани та старші офіцери, які пройшли спеціалізовані тренінги з медіації, мають можливість своєчасно виявляти напружені ситуації, запобігати ескалації конфліктів і забезпечувати конструктивний діалог між членами екіпажу. Це дозволяє підтримувати позитивну атмосферу на борту і знижує рівень стресу, що особливо важливо в умовах тривалих рейсів чи екстремальних погодних умов.

Програми навчання медіації для лідерів екіпажу допомагають їм краще розуміти різноманітні культурні підходи до вирішення проблем і знаходити найбільш ефективні стратегії для підтримки командної єдності. Це також дозволяє уникати ситуацій, де конфлікти можуть негативно вплинути на виконання завдань або безпеку судна. В результаті, командна робота стає більш скоординованою, а екіпаж – більш згуртованим.

Крім того, важливо зосереджувати увагу на розвитку командної спільноти через регулярні неформальні заходи, такі як спільні обіди, спортивні заходи або культурні обміни. Це дозволяє членам екіпажу познайомитися один з одним поза робочими умовами, що сприяє зміцненню довіри і взаємоповаги. Такі заходи допомагають зменшити бар'єри між культурами та створити більш дружню атмосферу на борту.

Загалом, кращі практики для управління змішаними екіпажами полягають у впровадженні чітких стандартів комунікації, розвитку лідерських навичок, міжкультурному навчанні та створенні здорової командної атмосфери. Ці стратегії сприяють не лише зниженню кількості конфліктів, а й підвищенню ефективності роботи екіпажу, що є

важливим для успішного виконання завдань і забезпечення безпеки судна в будь-яких умовах.

Досвід змішаних екіпажів суден підкреслює потенціал як для виняткових досягнень, так і для значних викликів. Подолання бар'єрів та сприяння інклюзивності дозволяють максимально використовувати переваги різноманітності. Майбутні дослідження мають зосередитися на довгострокових стратегіях підвищення добробуту та ефективності змішаних екіпажів.

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TECHNICAL SCIENCES

DEVELOPMENT OF AN ALGORITHM FOR CALCULATING THE RATIONAL PLACEMENT OF BALANCING DEVICES IN AN ELECTRICAL ENGINEERING COMPLEX WITH THE PRESENCE OF AN ELECTRIC MOTOR LOAD

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РАЗРАБОТКА АЛГОРИТМА ДЛЯ РАСЧЁТА РАЦИОНАЛЬНОГО РАЗМЕЩЕНИЯ СРЕДСТВ СИММЕТРИРОВАНИЯ В ЭЛЕКТРОТЕХНИЧЕСКОМ КОМПЛЕКСЕ С НАЛИЧИЕМ ЭЛЕКТРОДВИГАТЕЛЬНОЙ НАГРУЗКИ

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Abstract

In this research article, it is proposed to consider the development of a methodological approach to voltage balancing through the development of an algorithmic method for determining the rational locations for the installation of balancing devices in the electrical engineering complex of industrial enterprises. In addition, the trends in the development of an improved methodology for the technical and economic justification of the implementation of balancing devices in the electrical engineering complex with the presence of electric motor loads will be examined.

Аннотация

В рамках данной статьи исследования предлагается рассмотреть развитие методического подхода симметрирования напряжений посредством разработки алгоритмизированного метода определения рациональных мест установки симметрирующих устройств в электротехническом комплексе промышленных предприятий. Помимо этого, рассмотреть тенденции развития усовершенствованной методики технико-экономического обоснования внедрения устройств симметрирования в электротехническом комплексе с наличием электродвигательной нагрузки.

Keywords: Electric power system (EPS); Electric power quality (EPQ); Electrical engineering complex (EEC); Asynchronous electric motor (AM), Experimental studies of (EEQ).

Ключевые слова: Электроэнергетическая система (ЭЭС); Качество электрической энергии (КЭЭ); Электротехнический комплекс (ЭТК); Асинхронный электродвигатель (АД), Экспериментальные исследования (ПКЭ).

Введение

Качество электрической энергии (КЭЭ), связанное с несимметрией напряжений, одна из актуальных проблем в электрических сетях вьетнама.

Экспериментальные исследования показали, что несимметрия напряжений имеет достаточно высокий уровень, преобладает как постоянно действующий фактор при работе электрических сетей. Указанная ситуация, способствует повышению количества рисков технологических отказов, и главным образом, требует адаптивности эксплуатируемого электрооборудования [1].

Основной задачей исследования является разработка эффективных технических решений, снижающих уровень несимметрии напряжений до нормированных значений в ЭТК предприятий. Концепция такого подхода заключается в рациональном размещении технических средств симметрирования в зависимости от условий эксплуатации электродвигателей. Принятие решения по подбору наиболее предпочтительного средства симметрирования, помимо этого, определение экономически рационального места установки выбранного устройства, возможно реализовать основываясь на

экспериментальные исследования ПКЭ в электрической сети, данных о потерях мощности в элементах ЭТК, при этом учитывая рекомендуемые эксплуатационные режимы работы АД [2,4].

Материалы и методы

На (рис. 1) наглядно проиллюстрирована архитектура построения алгоритма расчёта рационального размещения устройств симметрирования в электротехническом комплексе с наличием электродвигательной нагрузки.

Методика расчёта представлена в следующей последовательности:

Шаг 1 – анализ исходных данных схемы ЭТК. Фиксирование информации о величине несимметрии напряжений, измеренной на вводе в рассматриваемую электрическую сеть.

Исходными данными являются:

- характеристика участка схемы ЭТК (общая информация об участке);
- параметры линий электропередачи (количество линий, длина линий; марка проводов и кабелей линий; нагрузка линий);
- параметры электродвигателей (количество и марка АД, значение рекомендуемой величины $K2U_{рек}$);

- параметры силового трансформатора (количество и марка трансформатора);
- величина коэффициентов $K2U$ и $K0U$ в расчётной электрической сети;
- стоимость электроэнергии.

Шаг 2 – переход к условию присутствия в электрической сети несимметрии напряжений. Если величина $K2U$ в расчётной схеме больше рекомендуемой величины $K2U_{рек}$ АД, переходим к следующему шагу.

Если «НЕТ», завершение расчёта.

Шаг 3 – поиск всех рациональных вариаций установки СС в ЭТК. Рациональными местами установки СС являются такие варианты, как: а) первый вариант – представляет собой установку СС на вводе в ЭТК,

В зависимости от конфигурации электрической схемы ЭТК может быть множество вариаций рациональных мест установки по первому и второму вариантам. В связи с этим, необходимо осуществить поиск всех существующих вариаций установки СС в ЭТК, примеры возможных конфигураций представлены [3]. При этом, оптимальная вариация внедрения СС в электрическую схему ЭТК определяется показателем «Приведённые затраты»

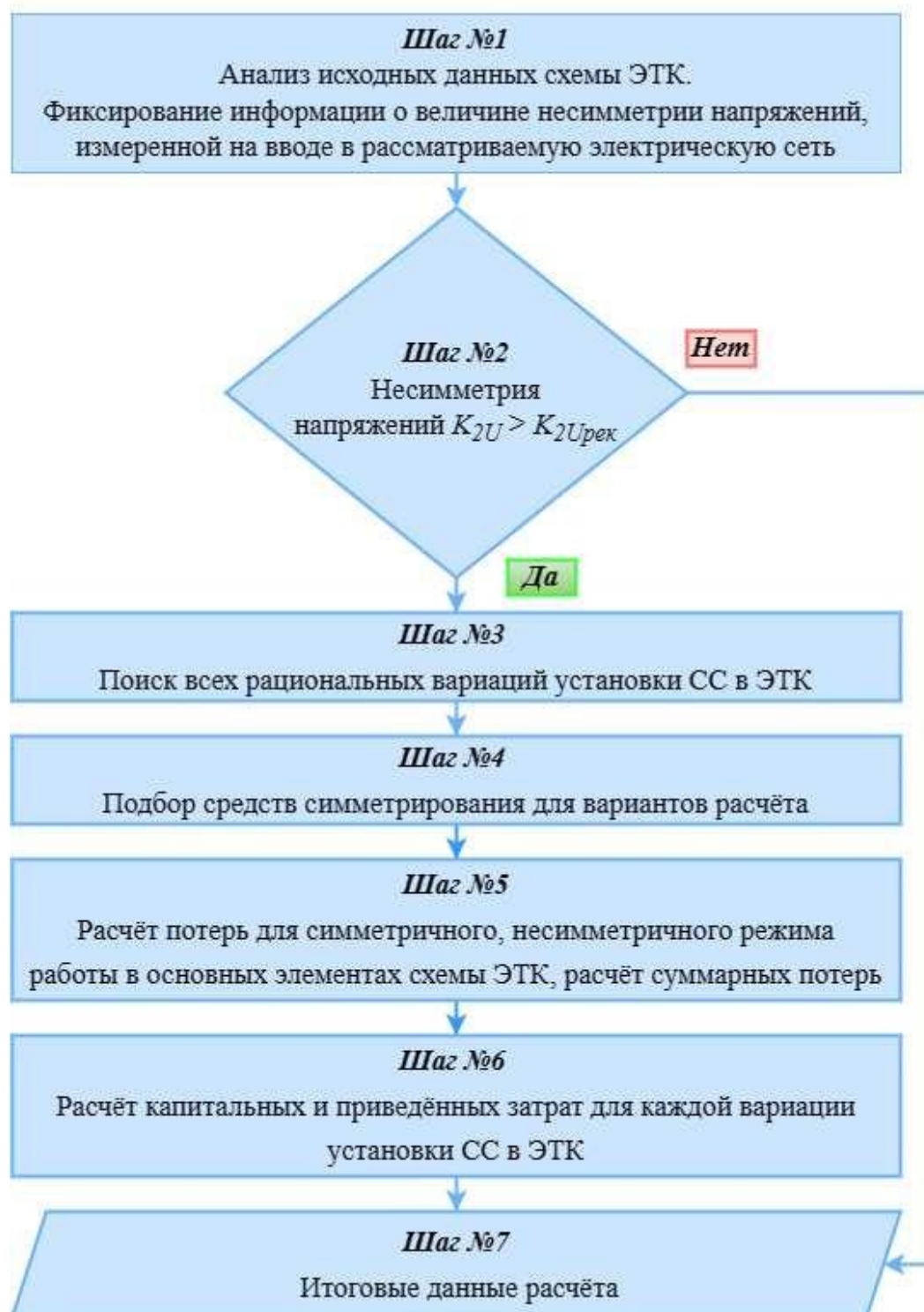


Рис. 1 – Архитектура построения алгоритма расчёта рационального размещения устройств симметрирования

Шаг 4 – переходим к осуществлению подбора подходящих средств симметрирования. Основными параметрами при выборе СС являются мощность устройства, его стоимость, функциональные возможности, выражающиеся в симметрирующей способности устройства. В зависимости от данных параметров производится расчёт различных вариантов расстановки СС [5].

Шаг 5 – расчёт потерь для симметричного, несимметричного режима работы в основных элементах ЭТК, расчёт суммарных потерь. Расчёт производится по исходным данным электрической схемы ЭТК.

Шаг 6 – расчёт капитальных и приведённых затрат для каждой вариации установки СС в ЭТК.

Выводы

Основным критерием оценки эффективности

принимаемых решений при проектировании месторасположения технических СС в ЭТК принимается метод минимума приведенных затрат [6]. Сопоставление приведенных затрат по рассматриваемым вариантам и поиск их минимума позволяет определить наиболее рациональные, с технико-экономической точки зрения, места их установки и оптимальный состав электрооборудования.

Рассматриваемый метод относится к статистическим без учёта фактора времени. Благодаря своей простоте метод нашёл широкое применение в задачах и моделях, направленных на технико-экономическую оптимизацию проектных решений при большом количестве оптимизируемых параметров. Метод позволяет существенно сократить нагрузку на вычислительные мощности при сохранении адекватного результата технико-экономической оценки [7].

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Yarov Yu.*Kyrgyz National University named after Zhusup Balasagyn*<https://doi.org/10.5281/zenodo.14766578>**Abstract**

This article examines digital technologies used for monitoring and managing construction projects. Key tools are studied, such as project management systems (BIM, ERP), the Internet of Things (IoT), Geographic Information Systems (GIS), as well as the application of big data analytics and artificial intelligence (AI). The article explores methods and approaches that enhance accuracy, safety, and efficiency in construction through the implementation of digital solutions. It also examines the advantages and challenges of integrating digital technologies into construction practices, including reduced project completion times, and cost savings.

Keywords: digital technologies, construction monitoring, project management, Building Information Modeling (BIM), Internet of Things (IoT), Geographic Information Systems (GIS), big data, artificial intelligence (AI).

Introduction

Construction is one of the fastest-growing industries, as this sector actively incorporates various innovative tools. One of the most significant changes is the use of digital technologies for monitoring and managing construction projects. The introduction of such methods substantially increases the efficiency, safety, and quality of construction work. It also contributes to reducing costs and project completion times. The digitization of construction covers varied aspects, from design and planning to the control of construction work execution.

The main digital technologies used in construction include project management systems, the Internet of Things (IoT), geographic information systems (GIS), as well as big data analytics and artificial intelligence (AI) tools. These project management systems help organize work efficiently and track construction progress, since they create a digital model of the project and provide access to it for all participants. The IoT technology allows for the integration of sensors that monitor the physical condition of structures, while big data analytics helps predict and prevent potential risks.

Another important aspect is the use of cloud platforms for data storage and sharing. It increases managerial processes and establishes maximum transparency at all stages of construction project implementation. The introduction of AI and machine learning (ML) into construction processes opens new opportunities for automating and optimizing workflows. These technologies considerably reduce the human factor and improve the accuracy of forecasting and planning. The aim of this study is to analyze the application of digital technologies for monitoring and managing construction projects, as well as to assess their impact on the efficiency and safety of construction.

Main part. Key digital technologies in construction monitoring

The advancement of digital technologies significantly transforms construction monitoring processes. It offers greater efficiency, safety, and precision in managing construction projects. Digital tools are increasingly being adopted to monitor various construction parameters, from structural integrity and environmental

conditions to project timelines and cost management. Research on construction supervision and quality control in prefabricated construction demonstrates that the application of digital technologies results in a high compliance rate, reaching 95.7% [1].

The implementation of Building Information Modeling (**BIM**) is one of the most significant innovations in modern construction. It is a digital representation of a building's physical and functional characteristics. This tool enables the creation of comprehensive 3D models of structures and systems [2]. Models serve as a shared knowledge resource for all stakeholders involved in the project. This can include architects, engineers, contractors, and clients, and allow them to work collaboratively throughout the entire lifecycle of a project.

This method improves the precision of construction plans and facilitates the monitoring of the project's progress. It allows for the tracking of construction turning points, resource allocation, and cost management. This helps in locating potential issues early in the process and prevents costly delays, and optimizes the overall construction process. Various BIM models can integrate data from IoT sensors. It allows for real-time monitoring of a building's structural performance during construction.

The **IoT** has a noteworthy impact in modern construction monitoring, as it supports the integration of smart sensors and devices that collect and transmit data in real-time. This equipment can monitor a wide range of parameters, such as temperature, humidity, vibration, and load-bearing capacity. It provides specific information about the building's structural health. One of the most significant benefits of IoT in construction monitoring is its ability to detect potential problems before they grow into serious issues. Sensors can monitor the stability of scaffolding, alerting workers to any shifts or weaknesses in real-time. These IoT devices can track the wear and tear of construction equipment, thus preventing breakdowns and ensuring the machinery operates efficiently [3]. This digital approach is particularly relevant in the construction sector, as incidents in this field account for one-fifth of all workplace accidents (fig. 1).

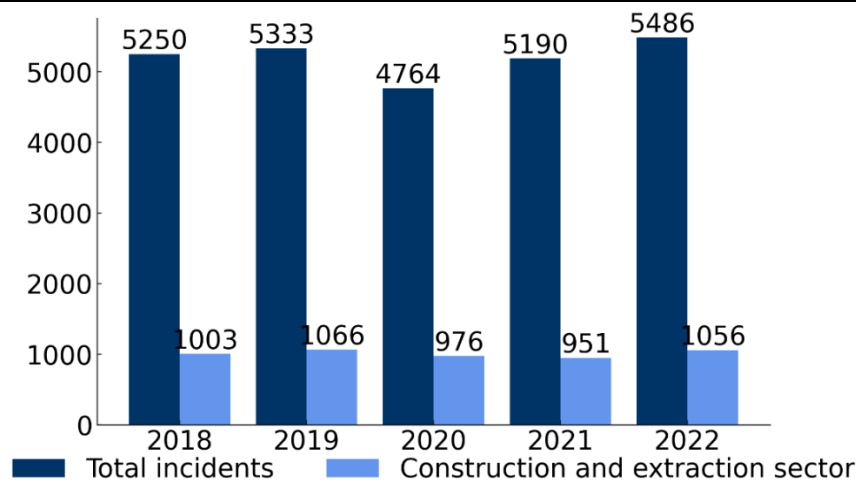


Figure 1. Number of fatal occupational injuries in the U.S. in the period of 2018-2022 [4]

To assemble, analyze, and visualize geographic data related to a construction project, **GIS** are widely utilized. This tool integrates spatial data with various types of information, such as environmental conditions, terrain analysis, and infrastructure details, to help construction teams make informed decisions about site selection, design, and planning. It can also be used to assess environmental impacts. In construction monitoring, GIS provides valuable insights into the progress of construction by comparing real-time data with initial plans. It helps track the movement of materials and workers, monitor construction workflows, and guarantee that safety regulations are being followed on the site.

Big Data analytics is affecting construction monitoring through facilitating the analysis of great amounts of data generated throughout the construction process. This data can include information from IoT sensors, BIM models, financial records, labor reports, and environmental data. By examining large datasets, construction managers can identify trends, discern inefficiencies, and make more informed decisions about project execution. The use of Big Data allows for predictive analytics, which can forecast potential problems, such as delays or cost overruns, before they occur. Big Data tools can predict the possibility of delays based on various risk factors. These features contain weather conditions or material shortages.

Additionally, **AI and ML** are progressively being applied in construction monitoring to improve action-planning, optimize processes, and reduce risks. The integrated AI can analyze data from multiple sources, such as IoT sensors, BIM models, and project management systems, to identify patterns and provide actionable insights. Various ML algorithms, alternatively, can continuously learn from the data and adapt to changing conditions. This feature makes them helpful for monitoring and predicting various aspects of construction projects. The AI technologies can be used to forecast the completion time of a project based on real-time data and historical courses. It can also be applied to identify possible safety hazards by analyzing data from sensors and cameras placed on-site. Models of ML can locate anomalies or deviations from planned schedules and workflows.

Drones and remote sensing technologies have become important tools in construction monitoring, allowing for aerial surveillance and data collection in areas that are difficult to access or hazardous. Drones are equipped with cameras and sensors and can capture high-resolution images and video, which can be used to create detailed maps and models of construction sites. These technologies are especially useful for surveying large areas, monitoring progress, and assessing the condition of structures. Experts can also use drones to monitor work safety by providing real-time footage of the site, helping project managers identify potential hazards or safety violations. Remote sensing technologies, such as LiDAR (Light Detection and Ranging), can create precise 3D models of the terrain.

Listed technologies can be used to track the progress of construction, verify the authenticity of materials, and make certain that all experts have access to accurate and most recent information. This level of lucidity helps reduce risks, improve efficacy, and enhance trust among project participants.

Managing construction projects using digital technologies

Digitalization brings revolutionary changes to the management of construction projects. Modern companies increasingly rely on digital tools to optimize workflows, improve efficiency and transparency. Some of the most significant advancements in this area are project management systems, such as BIM and **ERP** (Enterprise Resource Planning), as well as cloud platforms.

Project management systems such as ERP play a central role in organizing and controlling construction processes. These systems allow for the integration of various aspects of a project. It varies from planning and design to resource management and work execution. They provide project participants, including builders, architects, contractors, and clients, with access to a unified data platform, significantly enhancing coordination and efficiency.

Different ERP systems streamline and combine all business procedures linked to construction project management. Modules for financial management, procurement, personnel, and monitoring job performance are included. These systems make accounting, analysis,

and reporting easier, increasing transparency and decreasing the chances of human mistakes. Construction firms can enhance project efficiency, monitor budgets and deadlines, and enhance communication between departments. BIM enables in-depth modeling of construction procedures, simplifying the ability to predict costs, project durations, and reducing mistakes and resource wastage.

Modern construction projects often require the participation of numerous parties, including architects, engineers, contractors, and clients, making effective communication and information exchange crucial. **Cloud platforms** becomes a key tool for improving collaboration in construction with their ability to provide a centralized data repository and real-time access to project information [5]. Cloud technologies allow all project participants, regardless of their location, to work with a single digital model and most recent data about the progress of construction, fostering fast infor-

mation exchange and decision-making. Cloud platforms enable immediate updates to project documents, making the latest changes available to everyone involved, thus reducing the time required for approvals and corrections.

Cloud platforms also establish a high level of data security. They provide centralized storage for project documentation and support data recovery in the event of unforeseen circumstances, such as data loss or system failure. This significantly reduces the risk of losing important documents and increases overall project control.

Digital technologies are transforming construction project management by enhancing efficiency, accuracy, and collaboration across various project stages [6]. However, their application also presents challenges, involving cost, technical complexity, and the need for skilled personnel. Table 1 summarizes the key advantages and challenges associated with the use of digital technologies in this field.

Table 1.

Advantages and challenges of using digital technologies in construction project management [7, 8]

Advantages	Challenges
Improved precision in all stages.	High costs: significant investment required.
Better transparency: Enhanced visibility of project data.	Skill gaps: Need for trained personnel.
Improved collaboration: easier communication and coordination.	Data security: risk of cyber threats.
Optimized resource use: AI and ML improve scheduling and logistics.	Resistance to change: employees may be reluctant to adopt new tools.
Faster decisions: real-time data speeds up decision-making.	System integration: challenges in integrating new tech with existing systems.
Risk reduction: early detection of potential issues.	Maintenance: continuous updates and support needed.

Digital technologies can significantly improve the management of construction projects. The successful integration of these technologies also requires overcoming several technological and organizational barriers, which calls for a comprehensive approach to their implementation in the construction industry.

Conclusion

The integration of digital technologies in construction project management and monitoring offers substantial benefits. This can include enhanced accuracy, improved safety, and increased efficiency. Technologies such as BIM, IoT, GIS, and AI provide tools that enable real-time monitoring, predictive analysis, and effective collaboration among project stakeholders. Despite the challenges of high initial costs, data security concerns, and the need for trained professionals, the advantages of embracing these technologies are undeniable. In the future, construction projects will become increasingly complex, and digital tools will play an important role in minimizing risks, optimizing resources, and supporting sustainable development in the industry.

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