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Scientific-practical-experimental substantiation and ways of solving problems of ecological stability and human dental health

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Abstract: The results of a long-term scientific study on the negative impact of chemical, physical, biological, physical factors on the organism of workers and environmental environment of industrial enterprises of the Republic of Uzbekistan and neighboring state regions on the cause of the workplaces, the ecogigienic state in the ecological control regime and the production process were comprehensively evaluated. The authors say that in order to eliminate the influence of negative factors of the ecogigienic system on the human body, it is necessary not only to conduct activities in the area of one state or one territory, but also to simultaneously fight the existing states, non-governmental societies and people in the land sphere, to widely promote environmental concepts in the education.

Keyword: ecology, hygiene, dentistry, chemical elements, physical factors, biological factors, pollution of air, dental diseases.

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Introduction

The current ecological environment is a result of the irrational use of natural resources by humanity, the rapid growth of science and technology in the implementation of scientific achievements created by human intelligence, and the fact that the material needs of humanity prevail over spiritual views for the sake of well-being, which has led to unexpected problems in environmental sustainability in the 21st century. It is emphasized that every day, 500-500 million tons of ore are extracted from the depths of the Earth, 50-50 million tons of fuel are consumed; 60-100 billion m3 of air oxygen and 1-1.5 billion m3 of carbon dioxide are required for their combustion. m3 of water is consumed, but the useful product obtained is only 2-3%, and the remaining minerals pollute the environment as industrial waste. At a time when it is being emphasized that about 1.5 million of the world's population does not have enough to eat every day, about 50 thousand people die of hunger every day, 1.2-1.5 billion people are deprived of clean drinking water, 2 billion people are deprived of electricity, 1.6 billion people are illiterate, and the world's productivity has been lost by 20% - grain areas have decreased from 0.23 hectares per capita to 0.11 hectares, and it is emphasized that 20-25 million hectares of land are covered with sand and turned into deserts every year [3,9,19]. Currently, 50-50 kg of nitrogen, phosphorus and potassium fertilizers are used per hectare of fertile land on Earth, and the cost of mineral fertilizers is 500 million per year. per ton; including 1100 million for nitrogen. t., phosphorus - 670-700 million. t., potassium - 70 mln. t., these indicators are based on the fact that 150 kg of nitrogen, 100 kg of phosphorus, 75 kg of potassium fertilizers are used per hectare on gray soil lands in the Republic of Uzbekistan (UzResStatistics Collection (2008) 24). In fact, in enterprises on the territory of our Republic, pesticides; - nitrogen 600,000 t. (1990), 750,000 t. (1995), 954.5 t. (2007), 1 million 24.1 t. (2008), including; - 825.6 t., - nitrogenous, - 874.9 tons of phosphorus, - 128.9 tons of phosphorus mixtures, - 149.2 tons of nitrate mixtures and other chemical elements were produced, and the figures have been increasing over the years. [1,12,15]. It is worth emphasizing that, according to the data of the World Health Organization (WHO-2020), over the past 50 years, the number of new pathological processes and new types in the human body has increased

by 1.2 times, and the progressiveness of the process is also increasing worldwide. It requires the development of ecological strategy plans for ecologists, eco-hygienists, medical researchers, and other active public representatives [5,7,10].

The purpose of the study. Based on the results of retrospective and prospective analysis based on the evidence, to justify the negative impact of the ecohygienic environment on human health, especially on the activity of organs and tissues of the oral cavity, to improve the prevention, treatment and rehabilitation of diseases based on scientific, practical, experiences.

Materials and Methods

At the first stage - assessment of the importance of sciences and terminology related to the field; integrated complex analytical foundations of ecological, hygienic, physiological, clinical-dental, morphological, biochemical, biophysical, genetic, immunological, toxicological and experimental methods on animals.

- At the second stage; Tashkent, Navoi, Fergana regional sanitary and epidemiological services (2022-2024) Fergana Oil Refinery (FOR) - main group -1 (M/G-1); Assessment of the workplaces of the Almalyk Mining and Metallurgical Combine (AMMC) main group 2 (M/G-2) and the Navoi Chemical Plant (NavCP) main group -3 (NavCP-3), the environmental environment around the enterprise, as well as analysis of medical records of the enterprise workers in the medical and sanitary department (MSD) at the plants [2,8,20].

- In the third stage; 1600 people; including -1450 workers (M/G-1 – 420; M/G-2 – 425 and M/G-3 – 605 workers) and 150 people who applied to the clinic for dental care not directly related to production - the control group (C/G) (Table 1). The condition of the organs and tissues of the oral cavity was assessed using clinical, functional, biochemical, clinical-radiological and clinical-laboratory examinations and returned to the medical record.

Table 1. Distribution of people in the research group, age, gender, and work experience.

№	Age and work experience	Number of people in the study		men		women	
		total people	%	total people	%	total people	%
Total	Total	1600	100	1052	65,7	548	35,3
	M/G	1450	90,6	980	67,6	470	32,4
	C/G	150	9,4	72	48,0	78	52,0
Age group	20-24	165	10,3	125	11,9	40	7,3
	25-29	280	17,5	175	16,6	105	19,2
	30-34	375	22,3	202	19,2	173	31,5
	35-44	400	25,0	200	19,0	200	36,5
	45 and adults	380	23,75	350	33,3	30	5,5
Work	1-5 y.	425	29,3	270	27,5	155	32,9
	6-10 y.	528	36,4	365	37,2	163	34,7
	11-15 y.	385	26,5	250	25,5	135	28,7
	16 and more years	112	7,7	95	9,7	17	3,6

Anamnesis data; objective and subjective conditions - clinical, anatomical, morphological structures of the oral cavity organs and tissues, sensations, complaints, dental caries and nocaries injuries, periodontal tissue and oral cavity cavity diseases, the presence and etiology of dental prostheses were evaluated. Tooth sensitivity; ogric and discriminative sensitivity of the mucous membrane of the oral cavity; functional mobility of taste buds and receptors on the tongue; caries resistance of dental caries, microhardness of tooth enamel and dentin; condition of periodontal tissue (proby Schillera-Pisareva, PMA), hygienic condition of oral cavity, stasis of capillary vessels of periodontal tissue and RN-environment of mixed saliva (calorimetric method) were studied [4,11].

- In the fourth stage; annual reports of hygienic indicators at the workplaces of FOR, AMMC and NavCP and in the ecological zone around the enterprise were analyzed and the average indicators were more accurately determined - the combined effect of chemical compounds such as furfural, formaldehyde, phenol and acetone on the living organism was determined using clinical and experimental research - 120 mice were exposed to 3 different concentrations: - high concentration - 5 times the permissible limit of each chemical compound (1 group (1 gr.)), furfural - 50.05 mg/m3,

formaldehyde - 2.5 mg/m3 , phenol – 1.48 mg/m3, acetone – 0.99 mg/m3; at the level of permissible standard concentration ((2 group (2gr.), - 9.7 mg/m3; - 0.51 mg/m3; - 0.29 mg/m3; - 0.19g/m3); permission 5 times less concentration than the established norm (REM) ((3 groups 3gr.): - 2.06 mg/m3; - 0.1 mg/m3; - 0.06 mg/m3; - 0.04 mg/m3; - 4 groups (4 gr.) were evaluated in a chronic inhalation environment without chemical factors [6, 14, 17]. Linesterase activity, alkaline phosphatase, acid phosphatase, Alanine aminotransferase (ALT), aspartate aminohydrogenase (AST), liver enzymes: - succinate dehydrogenase; - histidase, erythrocyte sorption capacity were assessed at 0.5; 1; 2; 3; 4 months and with a monthly recovery period. At the end of the clinical experiment, metabolic activity in the liver , hexenal dormancy period, the amount of molecular peptide in serum, erythrocyte membrane permeability were studied, and the histomorphology of liver, oral mucosa, and gum tissues was studied in 4-5 μm thick sections stained with hematoxylin and analyzed in MBI-15. The results of the data were analyzed using the generally accepted statistical method - The analysis was performed using MS Office 2013 Excel software based on Student's criterion [13,16,18].

Results and its discussion

As is known, the sciences of ecology and hygiene complement each other in nature protection, preventing unfavorable eco-hygienic conditions in natural areas, and protecting humanity from various emerging diseases. Currently, Ecology consists of such areas as; "Industrial Ecology", "Chemical Ecology", "Biochemical Ecology", "Agricultural Ecology", "Military Ecology", "Psychoecology", "Social Ecology", "Human Ecology", and uses research methods - observing nature, conducting experiments, creating models, assessing the interdependence of humanity with its environment.

The term "Hygiene" and the words "Sanitation" are used in the sense of health, and also in the study of living organisms in the environment, human health, and working capacity. The "normative conditions" for the human body; environment, humidity, changes in movement, toxic gases in the air, dust, prolonged physical labor, stress, and in general, factors that disrupt the physiological processes of the body.

Urbanization - the growth of large industrial enterprises, cities, and vehicles - has accelerated in Uzbekistan, as in the rest of the world. WHO experts have noted that "medical services provide only 8-10% of human health, the remaining 20% of our health depends on hereditary factors, another 20% on the environment, and 50-52% on a healthy lifestyle." Physiological and pathophysiological changes and exacerbations in a living organism give the first changes in the mucous membrane and tissues of the oral cavity. The results of the above scientific research require the correct choice of the methodology of our research - a comprehensive approach and clarify the solution to our goal.

It was determined based on the data of sanitary epidemiology service: average in M/G-1: serum hydrogen - 10.0 mg/m³ (REM=0.008 mg/m³); benzene - 5.0 mg/m³ (REM=0.1 mg/m³); toluene - 65.0 mg/m³ (REM=0.8 mg/m³); gasoline - 105.0 mg/m³ (REM=1.5 mg/m³); phenol - 0.3 mg/m³ (REM=0.003 mg/m³); hydrocarbons (total) - 358.0 mg/m³ (REM=0 mg/m³); benzene 21%-48% in samples at different points of the enterprise; toluene 15%-33% is allowed standard amount; It was found that only in the 1st workshop there was 13 times more sulfur than the permissible norm, in the 2nd workshop - 12 times more benzene, in the 5th workshop - 4 times, in the 1st workshop - 1.8 times more gasoline.

At the workplaces of M/G-2; hydrogen sulfide, benzene, phenol, formaldehyde were found in various quantities - these chemical elements are of the 2nd hazard level, as well as stone and metal dust, sulfuric and acetic acids, methanol, tetrahydrofuran, formaldehyde were found to be higher than the REM in some samples.

In M/G-3: NO2, NO3, HCN, Ce2, CH3OH, CO, NAC, MA, MEA, CH2COOH, acetone, ammonia, and the concentration of ammonia and CO from these substances was 1.5-2.0 times; CH3OH 1.2-1.6 times; NO2, NH3, CO were found to be 1.2-1.3 times higher than the permissible norm in some samples. In M/G-3, in the air of workplaces, sulfuric acid exceeded the average permissible norm in 15% of samples, methanol - in 6% of samples, furfural - in 8.5% of samples, formaldehyde - in 4.5% of samples; the amount of dust in the workshops increased by -16.9 mg/m3, sulfuric acid aerosol by 1.1 mg/m3.

Dynamics of the level of VML among workers in 2022 and 2023: - M/G-1 - respiratory diseases (- 25.8%; - 29.8% in accordance); digestive system diseases (- 12.5%; - 14.3% in accordance); diseases of the musculoskeletal system (- 9.8%; - 9.6% consecutively), at the same time among

women 2.5-3.2% per 100 workers, 53.6-59.1 days of MLC per year; due to intestinal infections - 47 days, due to heart ischemia - 27.8 days, due to pneumonia - 22.5 days, due to nervous diseases - 20.5 days, due to fetal complications - 20.4 working days were lost: - M/G-2 respiratory diseases (- 29.3%]; - 32.9%); diseases of the digestive system (- 9.8%; - 9.6%); diseases of the musculoskeletal system (- 11.2%; - 7.6%); respiratory diseases in M/G-3 - 39.6%; diseases of the musculoskeletal system 8.1%; diseases of the kidneys and urinary organs 5.1%; diseases of the gastrointestinal system and liver 7.2%; other types of diseases are observed up to 5.5% with a tendency to increase, a similar picture of MLK as in M/G-1 is observed in M/G-2 and M/G-3.

The clinical and dental picture of the organs and tissues of the oral cavity of the study group was reflected (Table 2): the degree of caries prevalence in M/G-1 - 92.8%, M/G-2 - 89.9%, M/G-3 - 88.6%; intensity - CPE (caries, plomb, extracted) - 11.8; 10.2; In 10.4 matches: chemical necrosis M/G-1 - 15.2%, M/G-2 - 17.6%, M/G-3 - 22.6%, among C/G patients, we observe that these pathologies are a few times less common. Tartar and caries: 13.3% in M/G, 23.3% in M/G-2 and 18.8% in M/G-3, and 12.6% in C/G, localization was determined mainly in frontal lower and lateral upper teeth.

Table 2

Dental pathologies	Groups	FOR (M/G-1)		AMMC (M/G-2)		CP (M/G-3)		C/G	
		Number	M+B % x	Number	M+B % x	Number	M+B % x	Number	M+B % x
The prevalence of caries		390	92,8%	382	89,9%	536	88,6%	99	30,7%
CPE		420	14,8	425	11,6	605	13,2	150	9,6
Of these	C	1 per.	8,4	1 per.	4,6	1 per.	7,0	1 per.	2,4
	P		3,4		4,0		4,2		4,8
	E		3,0		3,0		2,0		2,4
Nocaries pathologies	PP	58	13,7%	67	15,8%	156	25,8%	17	11,3%
	CN	64	15,2%	75	17,6%	137	22,6%	11	7,7%
	MD	104	24,8%	69	16,2%	90	14,8%	12	8%
	TT and CC	56	13,3%	99	23,3%	114	18,8%	19	12,6%
Diseases of periodontal tissues	Gingivitis	75	17,8%	66	15,5%	130	21,5%	13	8,7%
	Periodontitis	206	49,1%	223	52,5%	315	52,1%	60	41,3%
	Parodontosis	35	8,3%	35	8,2%	60	9,9%	7	4,7%
Diseases of the mucous membrane of the oral cavity	Leukokeratosis	32	7,6%	26	6,1%	61	10,1%	5	3,3%
	Cheilitis	35	8,3%	28	6,6%	59	9,7%	6	4,0%
	Leukoplakia	73	17,4%	60	14,6%	117	19,3%	10	6,7%
	Glossitis	19	4,5%	18	4,2%	47	7,7%	6	4,0%
Orthopedic correct position and dental row	NNP	32	7,6%	38	8,9%	147	24,3%	90	60,0%
	PD	37	8,8%	40	9,4%	61	10,1%	63	42,3%
	NP	250	59,5%	251	59,1%	342	56,5%	16	10,7%
	M	151	35,9%	151	35,5%	232	38,3%	15	10,0%

Application: Pathological production-PP; Chemical necrosis-CN; Mechanical damage-D; Tartar and calculus- CC; No need for a prosthesis-NNP; Presence of dentures-PD; The need for a prosthesis-NP; Malocclusion-M.

According to the results of the study, periodontal diseases; - M/G-1 - 70.0%; M/G-2 - 75.1%; M/G-3 - 79.0%, as well as C/G - 54%: Including; moderate gingivitis; M/G-1 - 17.8%; M/G-2 - 15.5% and M/G-3 - 21.5%. According to the nature of the clinical course of gingivitis, swollen gums and flabby gums were observed, which were spongy and easily separated from the teeth. Also, pronounced atrophic processes were detected in the periodontal tissues - white gums, firmly attached to the teeth, but not to the neck of the teeth, but to their root part. The neck of the teeth was exposed, mainly on the lingual and lingual sides.

Diseases of the oral mucosa: M/G-1 – 37.8%, M/G-2 – 31.2%, M/G-3 – 46.9% and C/G 18%; including; leukoplakia M/G-1– 17.4%; M/G-2 – 14.6%; M/G-3 – 19.3% copper content is significantly different from C/G (6.7%). Clinical form of leukokeratosis - white, pea-sized spots from the head of the heel to the size of a pea, appeared on the surface of the skin and had a sunken red dot in the center.

The need for prosthesis is high in M/G patients; M/G-1 – 59.5%; M/G-2 - 59.05%; M/G-3 - 56.2% and in C/G only 7.35%: - have dentures; - 8.8%; - 9.41%; - 10.1% are in compliance; and C/G - 42.3%: the share of workers who do not need dentures - from 7.60 to - 24.9% in M/G, while in C/G this indicator was observed - 58.8%.

Functional studies: - Electroodontometry (EOD) was performed on 126 study participants: 35 workers from each M/G and 31 people from C/G for comparison; the upper jaw (U/J) central incisors (CI), canines (C), first molars (M) were selected as the study objects, and the electromotility (EOD) of 378 teeth was determined: CI U/J - 158, C U/J - 145, M U/J - 75: Results; M/G-1 decreased mobility threshold - the maximum (max) value is 52 μA, minimum (min) - 3 μA: average 28±2.4 μA; in I - 75 μA - upper limit, min - 2 μA, average 33.4±1.8 μA; 44 μA at M, min. - 6 μA, average 40.3±2.4 μA. M/G-2, max. value CI - 44 μA, min - 8 μA; average - 23.3±1.2 μA; At C - 60 μA, upper limit - 6 μA, average - 28.2±1.9 μA; 43 μA in M, min. 8 μA, mean 40.8±2.1 μA. In M/G-3 workers, these indicators were compiled: 58 μA, 4 μA; mean 29±1.4 μA; 85 μA in I, 1 μA, mean 31.4±3.8 μA; In M, 40 μA, 4 μA, an average of 35.3±1.4 μA were formed, respectively. At the same time, when studying C/G individuals, the results showed that in individuals with intact teeth, the threshold mobility ranged from 5 to 9 μA, and on average in CI - 7.5±1.2 μA, in C - 4.4±1.2 μA, and in M - 5.2±2.2 μA were observed. Analysis of the results shows that the threshold mobility of all studied teeth of M/G-1, 2 and 3 workers decreased significantly compared to C/G ($P<0.001$). At the same time, the amplitude of the decrease was different for different functionally oriented groups of teeth, so that in M and C, the EOD decreased by 4-7 times. The sensitivity of the neuroreceptor sensory apparatus in the oral mucosa was determined from 120 tests (30 people from each group) that the vestibular surface of the oral mucosa was more sensitive than the alveolar ridge ($P<0.001$). The neuroreceptor sensitivity threshold in the 4th tooth area of M/G workers was higher than the palatal surface of teeth 2 and 6 ($P>0.5$ - $P<0.05$). In the M/G group, the threshold on the palatal surface of tooth 2 was lower than the vestibular surface of the oral mucosa ($P<0.05$), but there was no significant difference in the indicators between teeth 2, 4, 6 ($P>0.05$). Taste sensitivity of the tongue was tested in 75 people (20 workers from each M/G and 15 people from C/G); - Results: 45 M/G workers complained of taste disturbance: the taste threshold was most pronounced for sour (31.2%) and bitter (25%), and the greatest decrease was for sweet (53.1%) and salty (59.4%); in M/G-2 workers - 45.2%; - 34.7%; 41.2% and 39.2%; in M/G-3 workers - 22.8%; - 28.9%; - 66.8% and 60.5%, respectively. Also, in most cases, when sweet and salty taste disturbance was detected, sour and sour-bitter taste disturbance were noted: in M/G-1 42.8%; 34.6%; in M/G-2 33.4%; 33.2%; in M/G-3 55%; 44.8%, respectively. When determining the sour and sour-bitter taste threshold, a violation of the sour-bitter sensation was noted: in M/G-1 22.4%; 31.1%; in M/G-2 43.6%; 48.2%; in M/G-3 35%; in 24.8% of cases, respectively. The available data indicate that there are significant differences in the decrease in the sour and bitter taste threshold in M/G workers and with C/G.

A study of tooth enamel microhardness was conducted on 55 molar teeth; M/G-1 - 20; M/G-2 - 20 and M/G-3 - 15 teeth; 10 teeth obtained as C/G with complications of periodontitis were compared. The study included: a) molar enamel - on the surface, thickness and dentin-enamel junction; b) dentin - on the dentin-enamel junction, dentin layer and 10 measurements. Studies of the CI of different layers of enamel in C/G individuals showed that the surface layer of enamel has the greatest value - it is significantly higher than other layers ($P<0.001$). The microhardness of the enamel layer is significantly higher than that of the dentin-enamel junction ($P<0.001$), but lower than that of the surface.

M/G workers were assessed by the Caries Resistance Test (CRT) on a 4-point scale; Level 1 - from 10 to 30%, Level 2 - 30-40%, Level 3 - 40-50%, Level 4 - more than 50% (Table 3).

23.2% of the M/G-1 examined were assessed as having a level 1 resistance to dental caries, 21.8% as a level 2 resistance, and the majority (55%) as a level 3-4 resistance: The pH of the saliva of M/G workers is acidic, while in C/G individuals the pH of saliva is slightly alkaline - 6.8. In our opinion, the pH of saliva changes as a result of interaction with substances such as air, acid gases, vapors, microdusts and furfural, furan, tetrahydrofuran, tetrahydrofuryl alcohol, furyl alcohol, ethyl alcohol, xylitol, varnishes, nitrogen, copolymers, phenol-formaldehyde resins, catalysts, food fungi,

Table 3. The state of the functional indicators of the examined.

Groups	CRT-test	Resistance level	GI (in points)	Demineralisation	Ph-saliva
FOR (M/G-1)	55,1±1,5^{x}	4^{x}	4,9±0,05^{x}	36,8±1,9^{x}	5,2±0,01^{x}
AMMC (M/G-2)	34,5±1,2^{x}	2^{x}	3,2±0,06^{x}	28,3±1,9^{x}	6,1±0,01^{x}
NavCP (M/G-3)	52,9±0,9^{x}	4^{x}	4,9±0,05^{x}	33,4± 2,2^{x}	5,4±0,01^{x}
C/G	22,4±1,3	1	1,4±0,03	6,3±1,0	6,8±0,02

acetone, sulfuric acid aerosol, hydrocarbons and acetone entering the oral cavity. The trace element composition of enamel, dentin, cementum, hair, blood and saliva was studied by neutron activation; materials were collected from 20 teeth and 12 hair, blood and saliva samples from each M/G; literature data were used for control. Results: (Table 4), silver (Ag) was absent in the enamel of M/G-1 teeth, the Ag content in the enamel of M/G-2 and M/G-3 teeth was 1.45±0.02; -1.88±0.22* close to the norm. In dentin, on the contrary, the Ag content in M/G-2 and M/G-3 was absent, and the Ag content in M/G-1 dentin was 3-4 times higher than the norm. The Ag content in dental cementum exceeded the C/G indicator by 2 and up to several hundred times. In all groups, the amount of calcium (Ca) in tooth enamel is higher than normal, and there is a tendency for the amount of Ca in dentin to decrease, especially in M/G-3 - 8 times (4.5±0.91*).

Table 4. The content of trace elements (Ca, Zn, Fe, Ag) in teeth, saliva and blood of FOR employees

Object analysis	microelements	Comparison group	FOR (M/G-1)	AMMC (M/G-2)	NavCP (C/G)
Enamel	Ca^{+2}	25,3+1,48	32,0+0,92*	30,8+1,36	29,5+1,13*
	Zn	185,0+11,3	136,0+16,7*	3763,0+131,0*	5361,0+261,0*
	Fe	32,0+1,41	60,0+0,44*	63,1+0,86*	14,4+0,33*
	Ag	2,2+0,01	-	1,45+0,02	1,88+0,22*
Dentinum	Ca^{+2}	36,0+1,6	29,0+1,4*	29,8+1,4	4,5+0,91*
	Zn	368,0+19,4	3780,0+124,0**	3881,0+144,0*	5173,1+98,6*
	Fe	-	3,4+1,68**	-	<1,0
	Ag	0,56+0,01	2,45+0,098	-	-*
Cementum	Ca^{+2}	26,0+0,91	0,68+0,041*	24,8+0,84	2,99+0,32*
	Zn	92,0+3,6	28,4+0,42*	3036,2+131,4*	2351,0+49,0*
	Fe	0,1+0,001	1,9+0,44*	471,8+42,1*	0,98+0,01*
	Ag	0,27+0,01	9,0+0,28**	2,4+0,23*	0,51+0,013*
Blood	Ca^{+2} mg/da	10,9+0,71	14,2+1,84	11,2+0,91	12,6+1,15
	Zn	112,0+10,6	86,8+3,5	76,4+3,21*	89,6+4,60*
	Fe	124,0+6,4	102,2+4,08*	96,0+3,19*	100,8+4,84*
	Ag	0,24+0,01	0,19+0,08	0,20+0,01*	0,22+0,08*
Saliva	Ca^{+2} mg/da	8.31+0.29	9,41+0,25	7,72+0,58	8.8+0.58
	Zn	30,8+1,46	36,4+1,94	74,6+3,76*	60,8+2,11*
	Fe	88,4+3,1	84,4+3,44	60,1+2,65	74,6+3,11*
	Ag	0,08+0,004	0,44+0,024*	0,06+0,003	0,09+0,054*
Hair	Ca^{+2} mg/da	1060+174	3480+420*	6080+17,44	5044+8,44
	Zn	225+8,5	210+30	180+4,54	140+4,5
	Fe	18+1,6	44,4+1,8*	48+1,64	38,4+1,45
	Ag	0,04+0,06	1,8+0,23	4,88+0,98	4,88+0,98

Note: * - P<0,05 reliability compared to the results of the control group.

In M/G-1 and M/G-2, the amount of iron (Fe) in tooth enamel was 2 times higher than in C/G, and in M/G-3, it was the opposite, i.e., almost 2.5 times lower. Normally, iron (Fe) is not detected in dentin, but in our study, it was present in large quantities (3.4±1.68**) in M/G-1 dentin. The amount of Fe in dental cement was 18 times higher than in C/G in M/G-1, almost 450 times higher in M/G-2, and 8 times higher in M/G-3. The amount of zinc (Zn) in tooth enamel in M/G-1 was 1.4 times lower than in C/G, 20 times higher in M/G-2, and 37-40 times higher in M/G-3. The amount of Zn in tooth dentin was 10-16 times higher than in C/G in all groups. In dental cementum, the Zn content decreased by 3-4 times in M/G-1, while in M/G-2 and 3 it was 250-300 times higher (2351.0±49.0*; 3036.2±131.4*). The results of the microelement spectrum determined in the studies indicate that

there are differences in the amount and quality of microelements in teeth, which is probably due to the influence of different production environments.

In the blood, the Ca content in all M/G workers increased compared to the C/G (P>0.05) and was within the upper limit; in saliva, the Ca content decreased slightly in M/G-2, and significantly increased in M/G-1 and -3. The Fe content in the blood and saliva decreased in all M/G compared to the C/G group (P<0.05).

It was also found that in individuals working in M/G-1, 2 and 3, the increase in acid phosphatase activity was higher (27.1±1.3; 29.6±1.2; 21.2±1.4) than in C/G (26.8±1.2) (P<0.01). This is due to the destabilization of lysosomal membranes and the shift of the salivary pH environment to the acidic side. The decrease in alkaline phosphatase activity (6.2±0.61; 6.4±0.72; 7.2±0.54) was lower than in C/G (9.1±0.88) (P<0.01) and is reflected in the enrichment of saliva with acid. Based on the above data, there is sufficient reason to conclude that the change in the enzymatic spectrum of M/G workers is mainly associated with the effects of harmful factors in production. The results of the preliminary study confirm that, as a result of exposure to occupational harmful factors, M/G workers working in industrial enterprises experience impaired taste analyzer function, negative changes in the pH environment of saliva, negative conditions in GI, PI and PMA indicators of the oral cavity, microhardness of tooth hard tissue, decreased resistance, negative clinical conditions in the oral mucosa and periodontal tissue are observed more often, in greater quantities and in more severe forms than in C/G. At the same time, it was observed that negative changes occur in a direct relationship with the increase in the length of service of workers and the deterioration of the eco-hygienic environment in the workplace.

As mentioned above, chronic poisoning in an artificially created environment - white rats in the experimental groups initially showed very anxious behavior, after 2-3 days the anxiety subsided, became heavy, and compulsively consumed food, and only after 2 weeks from the start of the experiment did the condition normalize. During the experiment, at the end of the 3rd month, the animals of group 1 lagged behind the C/G in terms of weight (P<0.05), and at the 4th month, the weight gain was not only in group 1, but also in group 2 animals (Table5).

Two months after the start of the experiment, the hemoglobin content in the peripheral blood of animals of group 1 was 119 g/l, with a mean of 136 g/l (P<0.05), at month 3 it was 102 g/l, with a mean of 130 g/l (P<0.05), and at month 4 it was 91 g/l, with a mean of 139 g/l (P<0.05). One month of rehabilitation was sufficient to normalize the hemoglobin content in animals of this group.

Table 5. Dynamics of biochemical and biophysical parameters during long-term cleaning of white rats with concentrations of mixtures produced by various inhalation devices.

Groups	Dynamics of body mass (in grams); inspection periods (months)						
	Fon	0,5	1	2	3	4	Recovery period
Body mass (g)							
I	101,5±3,1	115,8±4,6	121,9±3,6	139,9±2,2	146,8±2,9*	161,7±3,8*	194,9±5,9
II	100,1±2,96	117,3±4,2	131,5±3,73	140,8±2,51	155,7±4,68	170,4±2,94	203,2±3,7
III	102,2±1,38	110,2±3,5	125,1±2,8	139,4±2,67	160,3±2,53	180,3±1,72	202,7±2,8
IV (C/G)	101,9±1,91	111,7±2,2	128,3±1,59	134,3±1,75	160,8±1,82	178,7±1,24	200,4±2,6
Norkov reflex position (measured during 3 minutes);							
I	10,0±0,8	9,0±0,8	7,0±0,49	7,0±0,45	6,0±0,8	5,0±0,43*	9,0±0,8
II	10,0±0,8	9,0±0,8	8,0±0,8	9,0±0,8	9,0±0,66	7,0±0,43*	9,0±0,8
III	9,0±0,83	10,0±0,67	9,0±0,8	8,0±0,8	9,0±0,8	10,0±0,8	10,0±0,47
IV (C/G)	9,0±0,8	9,0±0,8	10,0±0,67	8,0±0,8	8,0±0,62	9,0±0,46	10,0±0,64
Hemoglobin content in peripheral blood (g/l)							
I	129±5,68	136±7,24	131±5,38	119±4,46*	102±4,86*	91±5,83*	107±4,19
II	133±4,71	132±6,99	135±3,94	138±5,67	127±5,91	111±6,69*	125±3,99
III	228±6,89	133±6,89	129±5,28	131±5,12	135±4,52	134±7,38	130±5,82
IV (C/G)	131±4,26	137±3,83	133±4,56	136±4,95	130±3,68	139±4,45	127±3,98

The amount of erythrocytes in the peripheral blood (Tera/l).							
I	6,1±0,25	6,18±0,1	5,11±0,03	4,79±0,05*	4,72+0,09*	4,79+0,03*	5,4+0,04
II	6,12±0,29	6,23±0,03	5,23±0,09	5,18±0,09*	4,86±0,02*	5,01±0,03*	5,9±0,03
III	5,28±0,34	6,14±0,03	5,32±0,03	5,16±0,03	5,34±0,02	5,06+0,03	5,4+0,07
IV (C/G)	6,3±0,08	6,17±0,02	5,16±0,03	5,22±0,03	5,28±0,02	5,04±0,03	5,4±0,03
The number of leukocytes in the peripheral pool (Giga/l).							
I	8,16±0,02	8,9±0,21	10,51±0,3*	9,32±0,48*	10,83±0,5*	12,6±0,46*	8,31±0,14
II	8,11±0,02	8,17±0,08	8,45±0,03	8,37±0,07	8,09±0,08	8,67±0,12*	8,02±0,21
III	8,01±0,02	7,48±0,09	8,09±0,04	8,18±0,06	7,75±0,04	8,12±0,08	8,04±0,9*
IV (K/G)	8,13±0,02	8,21±0,05	8,07±0,04	8,06±0,07	8,08±0,06	8,23±0,05	8,12±0,11
Sulfhydryl content (Giga/l) in the mine of arrow rats.							
I	0,59+0,09	0,51±0,09	0,51±0,09	0,49±0,07*	0,49±0,06	0,41±0,06	0,54±0,06
II	0,53+0,07	0,58+0,18	0,52±0,07	0,57±0,07	0,58±0,04	0,46±0,06	0,55±0,06
III	0,51+0,08	0,56±0,08	0,55±0,06	0,55±0,06	0,57±0,07	0,55±0,06	0,54±0,05
IV (C/G)	0,55+0,07	0,52+0,07	0,58±0,25	0,59±0,07	0,61±0,06	0,59±0,06	0,55±0,04
Activity of AP in the serum of white rats (mmol/l.hour)							
I	1,04±0,08	1,35±0,08*	1,9±0,09	2,02±0,07*	2,22±0,13*	2,55±0,15*	1,51±0,09*
II	1,16±0,09	1,22±0,09*	1,45±0,08*	1,94±0,09*	2,01±0,09*	2,12±0,08*	1,14±0,05
III	1,03±0,05	1,05±0,08	1,11±0,07	1,32±0,08*	1,11±0,08	1,09±0,09	1,15±0,08
IV (C/G)	1,05±0,07	1,04±0,08	1,09±0,07	1,09±0,05	1,23±0,09	1,10±0,09	1,13±0,09
AST activity in the serum of white rats (mmol/l.hour)							
I	1,61±0,08	1,64±0,09*	2,18±0,08*	2,31±0,08*	2,47±0,09*	2,93±0,08*	1,65±0,08*
II	1,41±0,07	1,32±0,08*	1,97±0,07*	2,01±0,07*	2,15±0,07*	2,7±0,06	1,52±0,07*
III	1,45±0,09	1,36±0,07	1,34±0,07	1,42±0,08	1,24±0,07	1,3±0,07	1,39±0,07
IV (C/G)	1,37±0,19	1,36±0,06	1,34±0,09	1,38±0,08	1,21±0,07	1,27±0,07	1,29±0,09
ALT activity in the serum of white rats (mmol/l.hour)							
I	1,18±0,07	1,52±0,09*	1,99±0,1*	2,07±0,12*	2,43±0,22*	2,54±0,21*	1,39±0,08*
II	1,12±0,07	1,25±0,36	1,34±0,07*	1,64±0,09*	1,95±0,16*	2,05±0,19*	1,16±0,09
III	1,12±0,07	1,22±0,07	1,21±0,07	1,49±0,08*	1,34±0,07	1,51±0,14	1,19±0,07
IV (C/G)	1,14±0,09	1,21±0,07	1,22+0,5	1,21±0,22	1,33±0,05	1,17±0,15	1,19±0,07
Cholinesterase activity in whole blood of white rats (u/l)							
I	280,3±28,9*	256,4±39,0*	240±20,5*	216±20,6*	167,6±16,7*	150,6±36,1*	266±16,7*
II	274,8+17,1*	269,4+9,0*	281,8+15,6*	270,6+16,7*	217,6+31,5*	196,3+21,4*	284+16,0*
III	277±24,2*	274,2±30,6*	285±18,8*	282±8,5	266±21,6*	273,2±23,1*	265+22,9*
IV (C/G)	279,9+24,5	276+13,7	281,2+28,9	282+8,5	284+16,7	266+21,7	290+12,6
Histase activity in the serum of white rats (mmol/l.hour)							
I	0,34±0,05	0,36±0,04	0,38±0,05	0,53±0,078*	0,72±0,09*	0,79±0,09*	0,81±0,08*
II	0,33±0,07	0,39±0,05	0,37±0,05	0,38±0,06	0,52±0,06*	0,58±0,11*	0,38±0,06
III	0,35±0,06	0,34±0,045	0,37±0,05	0,38±0,05	0,36±0,07	0,38±0,07	0,42±0,07
IV (C/G)	0,36±0,06	0,35±0,035	0,39±0,07	0,39±0,05	0,35±0,03	0,36±0,04	0,39±0,06
Sorption capacity of white mine erythrocytes (%)							
I	50,7+1,7	50,7+1,8	50,3+1,5	47,6+0,4	41,4+2,5*	37,1+2,9	35,2+1,4
II	50,9±1,6	54,9±1,7	53,2±1,3	54,3±0,3	43,3±1,6	40,9±3,8*	50,9±1,4
III	50,9+1,6	55,7+2,6	54,5+2,3	55,4+3,9	57,1+1,5	55,2+2,8	56,3+1,3
IV (C/G)	53,9±0,9	56,5±1,4	53,4±1,2	57,6±1,5	55,2±2,3	53,2±1,8	52,7±2,3

Note: * - P < 0.05 compared to the considered control group.

In group 1 animals, the activity of alkaline phosphatase, AST and ALT in the blood serum increased significantly at the 1st month, while the activity of alkaline phosphatase and ALT in group 1 animals did not reach the norm (P<0.05). The study showed that in whole blood of rats by groups showed that at the end of the 2nd month of treatment, a statistically significant increase in enzyme activity was observed in group 1 animals (P<0.05).

At the end of the experiment, a statistically significant increase in sleep time (P<0.05) was observed in animals of group 1, indicating a decrease in liver metabolic activity. Endotoxemia is manifested in the inhibition of mitochondrial respiration and impaired DNA synthesis and amino

Table 6. Activity of SDG, MMP, ECEM and duration of hexenal sleep in white rats (mmol/l.ch; and minutes)

Groups	Research deadlines	
	4 month	Recovery period
SDG		
I	1,03+0,04*	0,68+0,04*
II	0,54+0,09*	0,57+0,07
III	0,43+0,01	0,56+0,07
IV (K/G)	0,45+0,09	0,54+0,07
Duration of hexenal sleep in white rats.		
I	26,1+0,53*	20,6+0,5*
II	22,1+0,35*	19,1+0,53*
III	19,3+0,3	19,1+0,35*
IV (K/G)	19,3+0,53	18,8+0,35
Amount of medium molecular peptides (MMP) in blood plasma (U/E).		
I	0,152+0,013*	0,266+0,019
II	0,162+0,008	0,0309+0,013
III	0,298+0,016	0,300+0,016
IV (K/G)	0,295+0,019	0,330+0,016
Electrical conductivity of erythrocyte membranes in white rats (mv/sec).		
I	103,1+1,3*	71,6+0,2*
II	89,1+4,3*	57,6+0,2
III	64,9+0,2*	58,5+0,2
IV	58,1+0,2	57,9+0,2

Note: * - P<0,05 compared to the control group

acid transport, as well as a negative change in the amount of medium molecular peptides in serum, especially in animals of groups 1 and 2.

At the end of the experiment, the white rats were killed by decapitation, and the histomorphology of the oral mucosa, sputum and liver tissue was studied. In animals of group 1, the condition of the superficial mucosa compared to C/G - the epithelium is thinned over a long distance, with 4-5 rows of cells and a thin stratum corneum, in some places the stratum corneum is separated or completely absent, the basement membrane is thin, very rare; spindle cells are poorly differentiated, their nuclei are slightly elongated in a flattened position. The granular layer is thin, keratohyalin granules are clearly visible. Basal cells are defined, mitotic figures and dystrophic changes are visible, in some places there is dyscomplexation (Fig. 1)

Magnification 200 times.

Compared to C/G (group 4) and the lower permissible levels, a coarser and more unfavorable thickness of the epithelium was detected, as well as an increase in atrophic changes and signs of

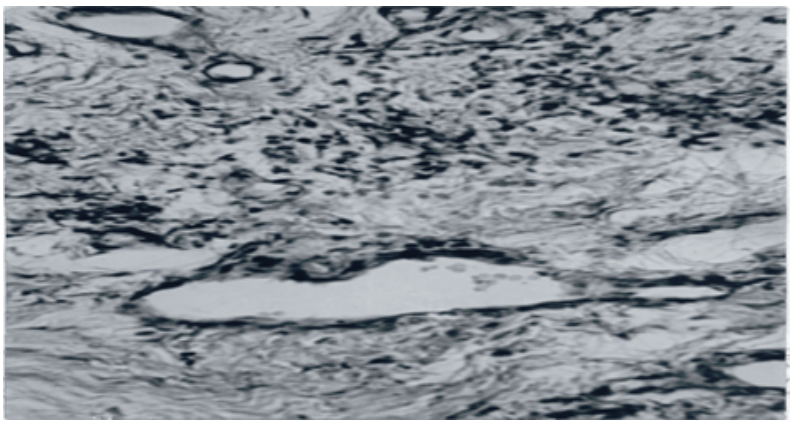

Figure 1. Facial mucosa in group 1 animals. Vascular dilation and perfusion, coarsening of fibers, focal lymphohistiocytic infiltration. Hematoxylin and eosin.

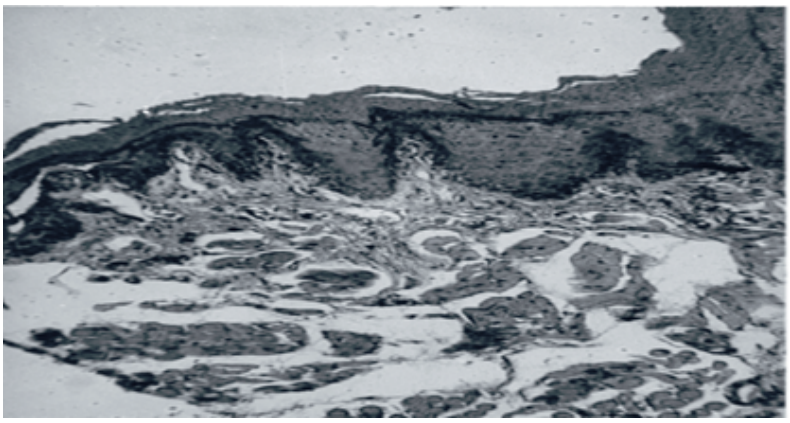

Figure 2. Group 1 animals have thickened areas of the mucous membrane, epithelial cover and cornea. An increase in the number of cell lines. Stromal tumor. Hematoxylin and eosin. Magnification 100 times.

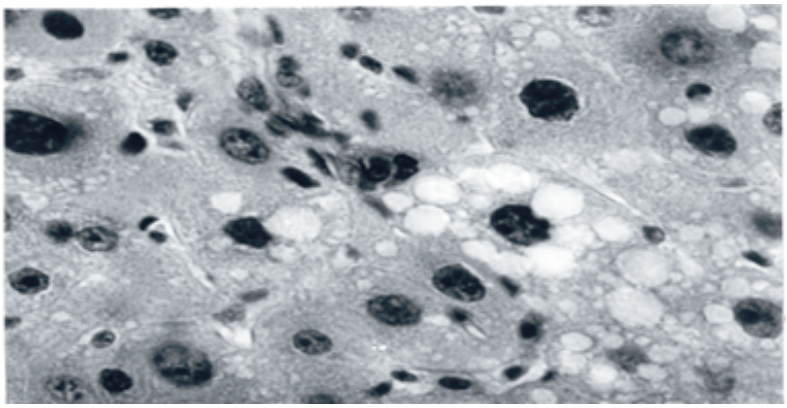

Figure 3. Liver of group 1 animals. Polyploidy nucleus. Presence of large hepatocytes, vacuolar and fatty dystrophy. Hematoxylin and eosin. Magnified 600 times.

dystrophy. In some places, the fragile layer was completely absent. In the papillary and lower layers, there were sharply dilated blood vessels, among which were numerous large mast cells, proliferation and coarsening of muscle and connective tissue fibers, as well as the presence of numerous large swollen epithelial cells and groups of mucous glands between them.

In animals of group 1, the gingival mucosa was disproportionate in epithelial thickness and in most cases the papillary layer was flattened, the basement membrane was not spread and in some places it was rare. The fragile layer was thin, in some places it was separated, sometimes layers were visible on its surface. The granular layer is poorly defined, with elongated cells and few keratohyalin granules. Epithelial thickness planes are characterized by scattering, swelling, and proliferation of cell rows. Signs of acanthosis and epithelial tissue infiltration into the connective tissue are noted (Fig. 2).

In the liver with changes in the vitality of group 1, the total vitality of partial and block exudates was preserved. Sinusoidal capillaries were located in several medium-sized areas with individual springs. The appearance of hepatocytes improved as a result of pericellular fibrosis. There was a decrease in the vitality of sinusoidal capillaries and an increase in Kupffer cells. Hepatocytes with a characteristic, homogeneous, weakly eosinophilic cytoplasm were mainly composed of segments with heavy (Fig. 3) and separated hyperchromic polyploid nuclei.

Thus, the polytropic effect of high-concentration (1st group) mixtures on the body of white rats is reflected in the activity of the central nervous system, as a result of which there is a negative effect on the functioning of the organs and tissues of the oral cavity. The combined "accumulation of effects" of chemical elements in the environment present in the workplace on the body - depending on the type, concentration and duration - leads to the formation of a general biological protective

reaction in various organ and tissue systems in response to the chronic and increasing impact of negative factors.

Conclusions

The leading adverse factors in the workplaces of enterprises in M/G-1 and 3 are phenol, formaldehyde, furfural, benzene, hydrogen sulfide, sodium hypochlorite; in M/G-2, sulfuric acid, benzene, stone and metal dust, acetic acid, tetrahydrofuran, which have a negative impact on the health of workers. The complex composition of chemical substances in the air of these production enterprises causes their transformation into chemical elements of the 1st and 2nd toxicity levels, as well as the humidity in the air, the addition of biological and physical elements in the air composition causes the formation of negative processes in the body of workers. Thus, the average rate of dental diseases among the workers of the above-mentioned FOR, AMMC and NavCP; the prevalence of caries is 90.43; the caries growth rate is 0.89; chemical necrosis - 18.43%; pathological decay - 33.2%; mechanical damage to enamel - 19.9%; defects in teeth and dentition - 18.5%; periodontal diseases - 74.7%; diseases of the oral mucosa - 38.7%; need for dentures - 58.4%; - temporomandibular joint pathologies - 36.6%, which is 1.5 to 5.5 times higher than the indicators among the C/G people in the study.

Indicators of non-specific local immune reactivity in the organs and tissues of the oral cavity among M/G workers: - sensitivity in the teeth and peri-gingival tissues up to 4-6 times; taste, odor and discrimination sensitivity decreased from 25% to -59.4% below normal; tooth enamel and dentin microhardness decreased by up to 13% on the enamel surface, 11.8% with a shift to the inner layer, and up to 1.2% at the enamel-dentin boundary: significant negative changes in the GI and PMA indices of the oral cavity confirm the direct or indirect effect of sanitary and hygienic indicators in the workplace on the tissues and organs of the oral cavity.

Chronic poisoning of white rats in an experimentally created environment; The direct role of the adverse sanitary and hygienic environment in the workplaces is once again confirmed by the negative clinical and functional changes identified among the workers in the research group, including changes in the vital reactions of organisms, negative changes in biosubstrates in urine and serum, and histomorphological indicators - negative changes in the mucous membrane of the oral cavity, mycelia and liver tissue - due to the exposure to various levels of permissible norms of chemical elements such as furfural, formaldehyde, toluene and acetone.

Authors' contribution.

S.A. Gafforov – Conceptualization, data curation, supervision,
D.R. Mo'minova – funding acquisition, investigation, validation.
U.Q. Nazarov – project administration, visualization.
N.S. Madaminova – methodology, writing—review and editing.
A.A. Sobirov – writing-original draft preparation, resources.
S.S. Gafforova – formal analysis, software.

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Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patients to publish this paper.

Data Availability Statement

The data presented in this study are available upon request from the corresponding author.

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Conflict of interest

The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Abbreviations

FOR	Fergana Oil Refinery
AMMC	Almalyk Mining and Metallurgical Combine
NavCP	Almalyk Mining and Metallurgical Combine

References

1. Agzamkhuzhaev S.S., Baybekova E.M., Bobozhonov A.S. The effect of inhalation exposure with a combination of furfural, formaldehyde, phenol, and acetone on the gingival mucosa of rats. "Problems of Dentistry" Journal, No. 4, pp. 19–22. Kazakhstan, 2002.
2. Agzamkhuzhaev S.S., Gafforov S.A. Diseases of the oral mucosa in workers of chemical industry enterprises in the Fergana region. "Dentistry" Central Asian Scientific-Practical Journal, No. 1–2, pp. 18–20. Tashkent, 2002.
3. Atabayev Sh.T., Olimov S.Sh. Environmental stability, dentistry, and human health. Guidebook for educators, medical workers, ecologists, and clinical residents of higher education institutions. Akademnashr Publishing, 330 pages. Tashkent, 2014.
4. Bakaev Zh.N., Gafforov S.A. The condition of the oral mucosa and periodontal tissues in secondary school students in the city of Bukhara. "KazNMU Bulletin" No. 4, pp. 584–588. 2019. Almaty. https://kaznmu.edu.kz/press/.
5. Bakaev Zh.N., Gafforov S.A. Diseases of the oral mucosa: pathological aspects and prevention principles. "Stomatologiya" No. 4 (77), pp. 75–79. 2019. Tashkent. https://inlibrary.uz/index.php/stomatologiya.
6. Baybekova E.M., Agzamkhuzhaev S.S. The effect of chronic exposure to a complex of substances (furfural, formaldehyde, phenol, and acetone) at various concentration levels on the condition of the cheek mucosa. "Dentistry" Central Asian Scientific-Practical Journal, No. 3–4, pp. 16–18. Tashkent, 2002.
7. Bekmetov M.V., Agzamkhuzhaev S.S., Zhumatov U.Zh. Occupational diseases of the oral mucosa and lips. Monograph. Abu Ali ibn Sina Publishing, 335 pages. Tashkent, 2004.
8. Gafforov S.A. Modern principles of treatment for diseases of the oral mucosa in workers of the chemical industry. Informational letter approved by the Ministry of Health of Uzbekistan (October 25, 2003) and RONMI GNMB No. 0116 (November 5, 2003). Tashkent, 2003.
9. Giyosova N.A., Gafforov S.A. Issues of ecological stability, dentistry, and human health. "Integrative Dentistry and Maxillofacial Surgery," Vol. 2, Iss. 1. https://doi.org/10.57231/j.idmfs.2023.2.1.028.
10. Idiev G.E., Rizaev Zh.A. Diseases of the oral mucosa and lips. Textbook for medical universities. National Encyclopedia of Uzbekistan Publishing, 396 pages. Tashkent, 2008.
11. Inoyatov A.Sh., Sharapov S.G. Analysis of the prevalence of congenital clefts of the upper lip and palate under unfavorable environmental conditions in Navoi region. "Problems of Ecology and Medicine" Journal, Vol. 14, No. 3–4, pp. 6–8. Ukraine, 2010.
12. Zholudev S.E., Nazarov U.K. Substantiation of the use of cobalt-chromium alloy in granule form for prosthetics in individuals living and working under unfavorable environmental conditions. "Vyatsky Medical Bulletin," No. 4(64), pp. 60–65. 2019. Russia. https://vyatmedvestnik.ru/index.php/vmv.
13. Ibragimova F.I., Gafforov S.A. Clinical and biochemical substantiation of the course and treatment of periodontal tissue and oral mucosa diseases in workers of synthetic detergents and cleaning agents production. "Medical Journal of Uzbekistan," No. 4, pp. 45–50. 2019. Tashkent. https://www.tadqiqot.uz/index.php/medical.
14. Idiev G.E., Gafforov S.A. Diseases of the oral mucosa in workers of certain branches of the chemical industry of Uzbekistan. Materials of the 4th International Medical Congress of Students and Young Scientists, pp. 332. Ternopil, Ukraine, May 21–23, 2002.
15. Isakov O.I., Nazarov U.K., Saidov A.A., Rakhimov F.E. The effect of a mixture of furfural, formaldehyde, phenol, and acetone on the oral mucosa and liver under experimental conditions. Collection of articles from the scientific-practical conference "The Role of National Ideology in Youth Education," pp. 98–101. Tashkent, 2010.
16. Mamedova F.M., Gafforov S.A. The effect of physical, chemical, microbiological factors, and natural cotton dust on the oral mucosa of workers in the dye-bleaching shop. "Dentistry" Central Asian Scientific-Practical Journal, N4/99/6, pp. 6–8. Tashkent, 1999.

17. Mamedova F.M., Gafforov S.A. Diseases of the oral mucosa in workers of modern textile production. Materials of the Republican Scientific-Practical Conference on Current Problems of Modern Dentistry, pp. 38–40. Bukhara, 1997.
18. Nazarov U.K., Dzhumaev Z.F., Musaev Sh.Sh., Gafforova S.S. Methods for determining biocompatible metal alloys to prevent galvanoses in individuals living in environmentally unfavorable conditions. "Integrative Dentistry and Maxillofacial Surgery," Vol. 2, Iss. 1, 2023. https://doi.org/10.57231/j.idmfs.2023.2.1.025.
19. Olimov S.Sh., Akhmadaliev N.N., Gafforova S.S. The impact of environmental factors on the condition of periodontal tissues in schoolchildren. Materials of the 15th International Conference "Ecology and Society Development," pp. 182–184. Russia, 2014.
20. Olimov S.Sh., Idiev G.E. Characteristic diseases of the oral mucosa observed in workers of the Mubarek Gas-Condensate Plant. "Theoretical and Clinical Medicine" Journal, No. 1, pp. 123–125. Tashkent, 2007.