

Sanitary-toxicological assessment of drinking water quality in the city of Grozny

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Abstract. The article presents the data of sanitary-toxicological studies on the assessment in a comparative aspect of toxicity and cumulative properties of drinking water from different places of water intake in the city of Grozny before and after water treatment. An assessment is made of the influence of drinking water quality on the health of experimental animals in a chronic sanitary-toxicological experiment.

1 Introduction

Arising from anthropogenic factors, erosion is actively initiated and parent rocks are exposed. The problem of monitoring the state of water resources, and especially their quality and the preservation of natural properties, is currently one of the highest priorities in solving problems of protecting public health. In the conditions of scientific and technological progress, the demand for water is constantly growing and at the same time the discharge of waste water is increasing. This process is accompanied by a deterioration in the quality of water sources and a limitation of the possibility of their use for industrial needs, irrigation, fish farming, cultural and household and especially drinking water use.

The problem of providing the population of the city of Grozny with high-quality drinking water is relevant and is associated with a change in the natural properties of water from the main sources of water supply under the influence of anthropogenic factors. The main sources of pollution are discharges of domestic, industrial and storm sewage of varying degrees of pollution. Of the total volume of wastewater, industrial accounts for about 17%, the rest - for the housing and communal complex. Heavy metal salts (HTM) deserve special attention in this, which have an adverse effect on the sanitary regime, organoleptic and toxic properties of water.: [Ilyin, 1980; Wise, 1996; Zholdako-va et al., 2000; Lutsevich, 2004]. Research by a number of authors: [Shtannikov et al., 1978, 1980; Korolev and Krasovsky, 1979; Eliseev et al., 1981; Lutsevich et al., 1987, 1996; Lutsevich, 2004] it is proved that reagent water treatment (chlorination, ozonation, etc.) is the main transforming factor of the substances contained in it, causing the formation of products with unfavorable organoleptic and toxic properties that pose a real threat to health population. In this regard, the purpose of this work was the sanitary-toxicological assessment of the quality of drinking water in the city of Grozny, obtained according to the generally accepted scheme of water treatment and an improved technological scheme.

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2 Research Methodology

For research, we used water in places of urban water intake and tap water in the city of Grozny. Comprehensive studies were carried out on a laboratory model of water treatment facilities in conditions as close as possible to natural ones, in accordance with guidelines approved by the Russian Ministry of Health (Collections of Guidelines, 1997, 1999, 2004).

The assessment of water quality in places of water intake and in the process of water treatment was carried out according to integral indicators. In organoleptic studies, the nature and extent of changes in smell, taste and foaming were studied. In sanitary-toxicological experiments lasting 6 months, 78 white rats were used (the 1st group of animals received artesian water, the 2nd, 3rd and 4th groups received water from different places of water intake and purified according to the traditional scheme, 5,6 and 7th group, respectively, purified according to an improved water treatment scheme).

Animal health status was assessed using a set of tests that integrally reflect the functional state of the body: behavior, general condition of animals, body weight dynamics, vitamin C content in internal organs, summation threshold index (STP), mass coefficients of internal organs (Hand-book..., 1975; Methodical guide..., 1991). Indicators were recorded on days 15, 35, 45 and 60 of the experiment; the data were compared with the indicators of the background and the control group. The results obtained were processed statistically according to generally accepted methods (Ashmarin et al., 1975).

3 Results and Discussions

The effectiveness of the use of generally accepted methods of water treatment was studied: primary chlorination, coagulation, settling, filtration, secondary chlorination in relation to water from different places of the city water intake. A slowdown in the dynamics of body weight on day 35 was noted in experimental animals that received water purified according to the traditional scheme. The number of erythrocytes in the blood of animals of all groups during the experiment fluctuated slightly, the hemoglobin content during the experiment did not significantly differ from the control. At the same time, inhibition of the activity of enzyme systems in the body of rats treated with drinking water purified according to the traditional scheme was revealed: a statistically significant decrease in the activity of cholinesterase (Fig. 1) and catalase was observed, which indicated the inhibition of oxidative processes.

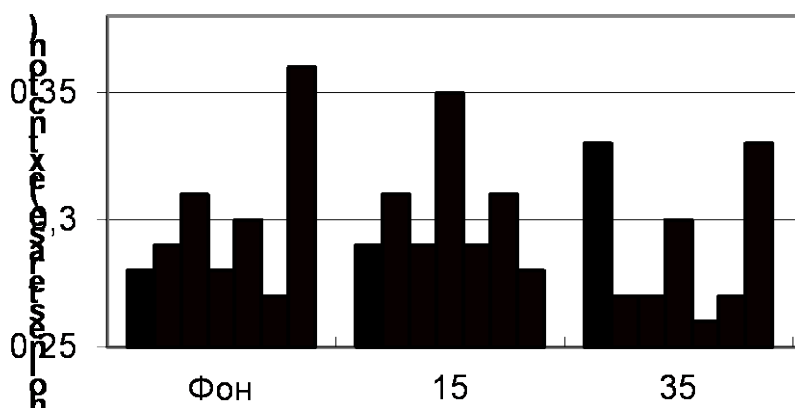


Fig. 1. Activity of total blood cholinesterase in experimental animals

Ascorbic acid, mg%



Fig. 2. The content of vitamin C in the adrenal glands of experimental animals

A significant decrease in the level of vitamin C in the body of experimental animals, especially in the adrenal glands, was established (Fig. 2); changes in the relative mass of internal organs were noted. Consequently, the transformation products formed in the process of chlorination of water from different places of urban water intake are not indifferent to the animal organism and influenced the functioning of a number of vital systems.

The conducted studies have revealed that the generally accepted methods of water purification at modern water treatment facilities are environmentally ineffective, and chlorination (along with positive qualities) leads to negative consequences - the formation of toxic products.

4 Conclusions

It is shown that the additional introduction of activated carbons and ozonation into the generally accepted scheme makes it possible to provide a higher environmental efficiency of water purification and free it from chemical contamination. The inclusion of these methods in the overall water treatment scheme is the best option that ensures high quality drinking water.

It was shown that the rats that received water from different places of urban water intake throughout the experiment, purified according to an improved scheme, did not differ from the control ones in their appearance, behavior, indicators of the physiological state of systems and organs. Thus, sanitary-toxicological methods have confirmed that water treated according to an improved technological scheme does not contain harmful substances hazardous to health that have an adverse effect on the systems and functions of the body.

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