
Ecological and Toxicological Conditions in the Delta Volga River

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The decrease in the level of industrial production and the significant reduction of highly toxic substances used in the agriculture of the Volga region in the last decade did not maintain the expected decrease of pollution level in the Volga water. Concentration of many polluting substances in water continues to remain high.

Among the numerous polluting substances in the Volga River two groups of highly toxic substances are significant: its chlorine organic pesticides and the heavy metals having high stability and accumulative effect.

The purpose of the research was to determine the most dangerous sources of pollution of a water ecosystem and the level of the Delta Volga River, as well as the ways of their migration and the amount of the toxic influence in the water's life.

Materials and methods

Sampling of water and ground for the subsequent analysis of the contents of heavy metals, mineral oil and sulfur-containing compounds was carried out in Volga – the Caspian channel and in reservoirs of the Volga-Achtuba flood-lands on various distances from a gas-processing factory.

Samples of bodies and issues of water's life were frozen and delivered to the contents of heavy metals and biochemical parameters in laboratory in thermoses with ice. Samples of tissues to histological analysis were fixed in Buin solution.

The common protein was defined according to V.S.A satiani's [1] method, and the common lipids were defined according to Folch [2]. The chlorine organic pesticides were defined by a method of gas-liquid chromatography [3]. The contents of heavy metals in biological objects were analyzed by atomic – absorptive method [4].

Results and discussion

For the last 15 years the average contents of heavy metals in the Volga water has increased. The average contents of copper (7.0 mkg / l) has increased 11,5 times, zinc (22.5 mkg / l) 3,8 times, lead (1.3 mkg / l) 5,6 times, cadmium (0.5 mkg / l) 4,9 times. Background concentration of copper and zinc in summer months exceeds 3 – 7 times over the value of maximum concentration limit. The level of mercury in water for last 3-4 years in intermittent months has increased from small quantities up to 2-3 times of the maximum concentration limits for fishing water use.

Having absorbed on particles of a suspension, ions of heavy metals are capable to coprecipitate, forming high concentration in ground sediments. Especially intensive, these processes proceed in a near estuary zone [5].

Here dredging and banks of a ground on specially allocated sites – dumps will be carried out periodically. It promotes an extraction of a part of the transitive form of metals buried in ground sediments in water to their involving in biogenic migration. In a zone of realization of the hydromechanized works concentration of the majority of heavy metals in water in comparison with background concentration is increased 1,5 – 4,0 times.

In gills, cloak, leg muscles of the two-folding mollusks (*Unio pectorum*, *Dreissena polymorph*) collected in area of a dump of a ground in Northern Caspian Sea, concentration of all elements appeared 1,5 – 7,0 time more than at molluscs at background stations. In bodies of chironomidae and the oligochaetas (*Chironomidae genuinae*, *Tubifex tubifex*) living near a dump of a ground, it is revealed up to 70 mg / kg of iron and up to 30 mg / kg of a lead accordingly. It is ten times higher than background parameters at these animals.

By the input from building the Astrakhan Gas-Processing Factory emissions in an atmosphere of sulphurous compounds have considerably amplified. It promotes formation of sour rains and conducts to a souring of reservoirs of the Volga-Achtuba Flood-lands. So, in the Achtuba River, in the Buzan River, in the Bereket Erik the hydrogen parameter in mean water is equal 7.2. In winter months snow and the top layer of ice on these reservoirs is characterized by downturn of a hydrogen parameter up to 5.1 – 0.9. The souring of reservoirs is accompanied by migration of metals from a ground in water. It creates on occasions, ecologically dangerous situation. In first two years after commissioning a gas-processing factory in reservoirs of the Volga-Achtuba flood-lands, the contents of the dissolved forms of metals have essentially increased. So, concentration of zinc in the water of the Achtuba River (30 mg / l) has increased 2.5 times, nickel (4.5 mg / l) 1.3 times, manganese (20.9 mg / l) 2.9 time. Concentration of cobalt in the Bereket Erik (0.8 mg / l) has increased 4.0 times. And that of mercury more than ten times. It reaches in intermittent months of the spring-and summer period to 2-3 times of the maximum concentration limits of fishing water use.

The increased contents of metals in water increase accumulation by the water's life. Research of mollusks in reservoirs Volga-Achtuba flood-lands has revealed the presence of specificity in accumulation of separate elements. So, *V. viviparus* more than other mollusks concentrate cobalt (6.4 mg / kg), copper (70.7 mg / kg), nickel (10 mg / kg). *D. polymorpha* more than other mollusks concentrate lead (18, 3 mg / kg) and cadmium (5, 0 mg / kg). *U. pectorum* in comparison with other mollusks concentrate more zinc (172.3 mg / kg) and manganese (4310 mg / kg). Copper and zinc concentration in *V. viviparus* and *D. polymorpha* bodies after commissioning the gas-processing factory has increased 1,5 – 4,0 times.

Inspection of bodies and tissues of the highest volume of fresh waters for all kinds of fish of these reservoirs (rudd *scardinius erythrophthalmus*, perch *perca fluviatilis*, silver bream *blicca bjoerka*) has shown, that concentration of mercury in muscles, at the common high variability reaches maximum amount (10 maximum concentration limits) in spring months. As a whole, for the years of

the activity of the Astrakhan Gas-Processing Factory the increased level of a copper in gills of the silver bream for 1, 2, times in muscles of the rudd 1, 8 times, and manganese in muscles and gills of all kinds of fish 6 – 10 times is marked.

Mutagenic activity of water in reservoirs of the Volga-Achtuba flood-lands, adjoining to a gaseous condensate factory was investigated. It has allowed establishing its authentic growth on 42 % for last 4 years. Especially high parameters of a mutagenesis of water were marked in the Buzan River (0.8 %) and in the Bereket Erik (1.3 %) in 1987. The same picture was observed in Volga River in region of the Narimanovo Town (1.86 %) in 1989 – 1990 [6].

The analysis of pollution of benthonic layers of water in the rivers of the Volga-Achtuba flood-lands with distance up to 20 kms from Astrakhan Gas-Processing Factory has shown a growth of the contents of sulfur-containing compounds on 34 % (0,187 mg / l). In two times the contents of mineral oil in water reached 0.54 mg / l. It is higher than the background parameters of 18 % for the Bottom Volga and more than 10 times is higher, than a parameter of maximum concentration limit (0.05 mg / l) for fishing water use.

Histological inspection of fish from reservoirs of the Volga-Achtuba flood-lands has revealed a number of pathomorphologic changes for the period of work of a gas processing factory [7]. In a spleen the parenchyma in all cases was diffusely impregnated with blood. In kidneys gleams of curve channels are narrowed and filled with protein. In muscles the extensive centers of destruction of protein are observed. Changes in a liver are more essential. Capillaries are also non-uniformly expanded and filled with blood cells. The local perivascular leucocytic seepage and significant swelling of endothelium cells were observed. The centers of a necrosis are revealed on some sites that the structure of liver was damaged. A special attention was paid to the growth of an epithelial tissue of branchiate petals at a significant part of the surveyed fish. We diagnose such pathology as a benign tumour. By observable displasia in an epithelium it is possible to explain total effect of influence of toxic pollutants. As a whole changes of morphology of cells can be considered as the answer of an organism of fishes to the chronic

intoxication, demonstrating compensatory-adaptive character.

Accumulation of pollution, including heavy metals, in water ecosystems Volga-Caspian pool redereed negative influence on a physiological condition of fishes, first of all sturgeon. At individuals with stratification of muscular tissue cases of very high contents of separate elements in muscles, a liver, gills and gonads are observed. So, for example, the contents of mercury in ill fish in muscles (0,284 mg / kg) 3,0 time, a liver (0,345 mg / kg) in 5,5 times, in caviar (0, 104 mg / kg) in 2,1 times is higher than the externally healthy fish . On the other hand concentration of some elements in ill fish corresponded to their contents in bodies and tissues or was lower, than the amount in healthy fish. Such a situation, in our opinion, may be interpreted as pathologic caused by infringement of regulator mechanisms of a mineral balance in ill fishes.

Through comparing the separate biochemical parameters at sturgeons with seen oecological-morphological changes into healthy fish it is revealed, that in ill fish the quantity of the common lipids is 1,6 times more than in externally healthy individuals .

By comparing the total amount of chlorine organic pesticides in the liver and muscles of healthy and nonhealthy fish the miopatia reveals statistically authentic distinction in their contents. In healthy fish the quantity of chlorine organic pesticides in a liver made 0,249 mg / kg, and in muscles – 0,129 mg / kg of crude substance. In ill fish the contents of pesticides in these bodies appeared to be 1, 4-1, 5 times higher. Between the contents in muscles and a liver of the common lipids and chlorinorganic pesticides a positive correlation that proves high solubility in lipids of chlorinorganic pesticides [8, 9] was traced.

Conclusion.

The data received as a result of supervision prove that ecological and toxicological conditions in the delta of the river of Volga remain intense. Accumulation of polluting substances in the water environment, deterioration of the biological and physiological-biochemical parameters of water's life continues.

It is necessary to count display of negative consequences of these phenomena, as well as the pathomorphologic changes of cells and organs at many trade kinds of the fish.

Scape from the created position may be the immediate acceptance of radical measures for the improvement of ecological conditions on Volga.

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