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Changes in Chemical Composition of the Ukrainian Surface Water

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The period from 1991 to present days is unique for the natural environment of Ukraine, in general, and aquatic ecosystems, in particular. The point of issue is a significant decrease in the levels and rates of the anthropogenic impact. The main emissions of chemicals into various natural environments were a result of functioning energy sector of the Ukrainian economy. The economic downturn, which began in 1991, led to a significant reduction in energy consumption and, consequently, a decrease in emissions of pollutants into the environment. For example, only from 1990 to 2000, coal mining in Ukraine decreased from 155 to 80 million tons, and total energy consumption decreased from 326 to 145 million tons of reference fuel.

From 1990 to 2015, the total emissions of nitrogen compounds decreased from 2.4 to 0.56 million tons, and sulfur dioxide compounds – from 2.2 to 0.75 million tons. Concentrations of these substances in atmospheric precipitation and the Ukrainian surface water (part of the Dnipro basin, the Prypiat, the Desna, the Dniester, the Danube, and the Western Bug), i.e. the rivers with a washing regime of moistening and low natural background of above-mentioned substances, decreased almost synchronically.

Based on the processing of long-term information on the chemical composition of the surface water of Ukraine and data on the chemical composition of precipitation, the hydrochemical zoning of the surface water of Ukraine was carried out by the elements of salt composition, nitrogen and phosphorus compounds, and dissolved organic matter.

In addition to assessing the influence of anthropogenic factors, the climatic and geological conditions were indentified playing the key role in formation of the main ions composition and the overall mineralization of the surface water of Ukraine. The nature of the soil cover, the ratio of precipitation and evaporation in combination with different regimes of groundwater levels and air temperature are the determining factors for changes in concentration and the ratio of major ions and the magnitude of water salinity.

It has been shown that for the rivers of Ukraine with a washing regime of a soil complex and a carbonate composition of water-bearing rocks, water of hydrocarbonate-calcium type with salinity of 250-500 mg/dm3 and with a balanced content of basic cations and anions is formed. With a decrease in precipitation and an increase in air temperature from the northwest to southeast of Ukraine, there is a change in soil cover (from sandy podzolized soils to chornozem) which are composed of high natural contents of sulfate and chloride salts of sodium, magnesium, and calcium and are also characterized by a high capacity of cation exchange of the soil complex. These factors lead to a change in the chemical composition of surface waters from the hydrocarbonate-calcium type to sodium-sulphate one. In the last decade, most likely due to a rise of summer temperatures and an increase in the share of the underground contribution to runoff, there has been an increase in water salinity in the rivers of the southern and southeastern regions of Ukraine.