Heavy metals in the rivers Dnieper and Danube and the role of intra-reservoir processes in the migration and transformation of their compounds

By P. M. LINNIK

With 4 figures and 2 tables in the text

Abstract

The results of many years of investigation into the content and migration forms of a number of heavy metals (Mn, Cu, Zn, Pb, Cr) in the water of the Dnieper and the Danube are considered. Comparative appraisal of the influence of adsorption and complexing processes on the migration mobility of the investigated metals, and the ratio of their forms existing in waterbodies with different hydrological regimes, are given. The importance of investigating these processes for estimating the ecotoxicological state of aquatic ecosystems is shown. The binding of heavy metals in complexes with dissolved organic matter (in the Dnieper reservoirs) or their adsorption on to suspended particles (in the Danube) are the main cause of a low content of free ions as one of the most toxic forms.

Introduction

The heavy metals (HMs) are an important group of chemical pollutants in surface waters and render an appreciable influence on the functioning and bioproducitivity of water ecosystems. However, the degree of the toxic effect of HMs on hydrobionts is determined not so much by their general presence in water as by their concentrations and the ratio of coexisting forms (LINNIK & NABIVANETS 1986, MOORE & RAMAMOORTY 1987).

In natural water ecosystems, diverse physicochemical and biological processes promote a decrease in toxicity of HMs or complete their detoxication. To such processes are attributed: adsorption of metals on suspended particles; complexing (mainly with naturally occurring organic ligands); sedimentation and cosedimentation; hydrolysis and formation of slightly soluble compounds; accumulation and adsorption of HMs by biota.

It is difficult to give the relative importance of some of these processes, as various types can play the dominant role in the transformation of HM compounds according to the hydrological regime of differing waterbodies.

The results of long-term investigations of some HMs (Mn, Cu, Zn, Pb, Cr) in the largest European rivers, the Danube and the Dnieper, are considered in the present report. The Dnieper is a multipurpose water artery which is of great importance in the