

DISTRIBUTION OF COPPER IN THE WATERS OF RIVER NERETVA

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ABSTRACT

During the past few decades, the water of the River Neretva in the area of Konjic, Jablanica and Mostar has been exposed to various pollutants, especially those from the industrial complex "Igman", "Unis", "Sipad" and the textile factory "Đuro Salaj". Intensification of the economic capacities of these companies, as well as a number of agricultural and other activities, can copper to degradation of water quality of the Neretva River. The particular problem poses the fact that the waters of the River Neretva are retained for longer periods of time at the existing hydro accumulation reservoirs (Jablaničko, Grabovica, Mostar), which facilitates and accelerates the process of eutrophication. The main object of this study was to determine the level of distribution of heavy metals in the waters of the Neretva River. Knowing the content of metals in water and in particular the way of binding in sediments and the possibility of their mobilisation, transport and accumulation, is important for the assessment of water quality and for understanding of chemism that takes place in the aquatic system. Investigations included eight sampling sites: Spiljanski bridge, 2-3 km northeast of the town of Konjic, the confluence of tributary Tresanica, underneath the motel Konjic, the confluence of tributary Neretvica, HE Grabovica (300-400 m below the dam), the confluence of tributary Drezanka, HE-Salakovac (200-300 m below the dam), HE-Mostar (200-300 m below the dam).

1. INTRODUCTION

Water is one of the most important natural resources. Activities of modern man every day more and more increasing risk of water contamination, air and land. Water have always had a great influence on the development of civilization, because they are most associated with food production.

Neretva River with its tributaries is the source of life for the inhabitants of Herzegovina and Neretva river quality monitoring is necessary in order to preserve this natural resource, or use their water for drinking, irrigation, industry, recreation and other purposes. One of the measures of protection and conservation of the river is the implementation of monitoring, which represents a permanent monitoring of all parameters in the water, especially monitoring of the hazardous and noxious substances content.

The main motive of this study was to determine the level of distribution of heavy metals in the water of the Neretva River along the flow of Konjic, Jablanica and Mostar. The results will be used to calculate the sorption equilibrium between the concentrations of metals in water and sediment, to determine ecochemical detailed characterization of this part of the Neretva river.

2. RESEARCH AIMS

The objectives set in this research can be defined in the following tasks:

- Determine the distribution of metal copper in the water of the Neretva river along the course of Konjic, Jablanica and Mostar.
- Statistically processed the results of chemical analysis and interpret results in accordance with their precision and reliability
- Diagnose the possible repercussions that may result in the degradation of water and the future development of certain activities.
- Animate relevant institutions to protect water resources from possible consequences that may arise from an unreasonable attitude of man towards the natural resources in the study area.

3. EXPERIMENTAL WORK

3.1. Sources of pollution of the Neretva river in the research area

During the past few decades, the flow of the Neretva River was exposed to the effects of various harmful substances, especially from the factories that were part of the military industrial complex “Igman” in Konjic, then a variety of different industries in Konjic, Jablanica and in the northern basin of Mostar. Given that factories are by metalproducing characters, they were heavy metals pollutant derived from waste water generated in technological processes and in particular from waste water generated in the galvanizing.

Waste water of these industries was heavily enjoy in the water of the Neretva and could have a direct impact on the quality of the Neretva River, and a negative effect on the chemistry in the water system and pedogenetic processes.

3.2 Research areas

According EU standards for validity of experimental data was taken selection of areas which will be sampled for water analysis. In the investigated area was selected eight sites for the measurement point. Looking downstream from the Spiljanskog bridge near Konjic to the northern entrance of the Neretva river in Mostar, the order location for sampling was as follows:

1. Neretva River (100 m above the Spiljanskog bridge)
2. Trešanica (mouth of the river in the town of Konjic)
3. Neretva (near Motel Konjic)
4. Neretvica (firth near Butrović polje)
5. HE-Grabovica (300-400 m below the dam)
6. Drežanka (50 m, above the bridge in D. Drežnica)
7. HE-Salakovac (200-300 m below the dam)
8. HE-Mostar (300-400 m below the dam)

3.3 Water sampling for the determination of metals

In each locality, the composite sample was collected from eight separate samples, taken from the left and right banks of the river environment, in the proportion 3:3:2, According to the scheme of Figure 1. individual samples was taken with a polyethylene bottle at 0.5 m below the water surface. On the spot, one liter of composite sample was formed and preserved with concentrated nitric acid and the amount of 2 ml / l and then labeled, to avoid samples substitution, and transported to a laboratory in cooling device.

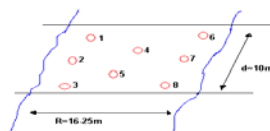


Figure 1. Scheme of order of sampling places from stream of Neretva river

3.4. Determination of metal content in water

Method: AAS - flameless techniques

Metal content of copper in water, was determined from acid water solution, the instrument AAS, AA - 6200 – SHIMADZU. Used with certified standards of water quality: HC 781 459 metal (Cu). content is used by the manufacturer Merck.

The analysis results are presented for all samples in Table 1. and represent the average value of three determinations. **Accuracy of results is shown via standard deviation.**

Table 1. Content of copper in water

Metal content ($\mu\text{g}/\text{dm}^3$)	Sampling point			
		1. Neretva (Spilj.bridge)	2. Trešanica	3. Neretva (nearKonjic motel)
	21,2 \pm 7,24	28,7 \pm 5,86	25,2 \pm 4,66	21,5 \pm 4,62
	5. HE-Grabovica	6. Drežanka	7. HE-Salakovac	8. HE-Mostar
	14,6 \pm 3,29	8,2 \pm 5,18	12,2 \pm 5,40	16,4 \pm 3,86

4. DISCUSSION OF THE RESULTS

In accordance with the objectives of this study determined the distribution of copper metal flow along the river Neretva from Konjic to Mostar. These sites were selected due to many years of metal industry, which could be a source of water pollution in the observed area. Content and distribution of metals in the waters of Neretva cause the properties of the substrate, hydrology, climate, and other anthropogenic factors.

The concentration of copper at the study sites is represented on the histogram, Figure 2.

Measured concentrations of copper, along the Neretva river, were found to range from 8.2 ($\mu\text{g}/\text{dm}^3$) to 28.7 ($\mu\text{g}/\text{dm}^3$). Maximum concentrations of metals of 28.7 ($\mu\text{g}/\text{dm}^3$) was found at the micro - second location, mouth of tributary Trešanica, while the minimum of 8.2 ($\mu\text{g}/\text{dm}^3$) measured at the micro - the site 6, the mouth of tributaries Drežanka. It is noticeable that the concentration of copper in samples downstream of all dams, significantly more than the other samples, except sample from Drežanke, where the measured concentration of 8.2 ($\mu\text{g}/\text{dm}^3$). At sites 1, 2, 3 and 4, observed the concentration of this metal are slightly higher ranging from 21.2 ($\mu\text{g}/\text{dm}^3$) to 28.7 ($\mu\text{g}/\text{dm}^3$). Mean concentration of copper was 18.0 ($\mu\text{g}/\text{dm}^3$), \pm 6.42.

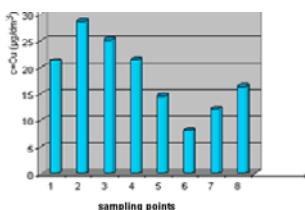


Figure 2. Histogram of distribution of copper in Neretva river

These sites are specific for their heavy metals and this specificity may be due to an upstream external or internal sources. On the distribution of metals in the waters of the Neretva river are the natural effects (erosion, rainfall and wind), where can not ignore the human impact, and a small distance to the main road M - 17, which extends along the observed flow of the river Neretva. Based on survey data collected can be drawn the following conclusions:

1. The results show a low level of metal copper in the waters of Neretva , the measured values were within prescribed limits to meet the Water Framework Directive of the EU.
2. Reason for low levels of metals in water, can be linked with the fact that in the study area, especially in urban areas through which flows the river Neretva, existing industrial facilities operate with significantly reduced capacity.

3. The differences in the content of metals in water, in some localities, are the characteristics of those sites. This specificity is mainly caused by different geological composition of the existing surrounding rocks, as well as the potential anthropogenic sources of metals (the immediate proximity of a number of landfills suspicious composition).

4. Representation of the sequence of metal copper in the waters of the Neretva river sites was as follows;

$$6 < 7 < 5 < 8 < 1 < 4 < 3 < 2$$

This study was to establish the level and distribution of metals in the waters Neretva, which could reach into the water, as a result of many years of metal industry Konjic. Research results represent a significant contribution in the assessment of environmental pollution and diagnose the possible repercussions that may result in the degradation of water and the environment a major tourist areas of Bosnia and Herzegovina.

5. REFERENCES

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