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# ASSESSMENT OF POLLUTION LEVELS IN AQUATIC ECOSYSTEMS THROUGH LIVER ENZYME ACTIVITY OF FISH

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**Introduction.** Aquatic ecosystems represent an integral component of the Earth's biosphere, and their ecological stability directly affects overall biological diversity and human health. In recent years, chemical contamination of water bodies resulting from industrial effluents, agricultural runoff, and domestic waste has escalated to the level of a global ecological problem. In particular, toxic compounds such as heavy metals, pesticides, phenols, and petroleum products pose serious threats to the biota of aquatic environments.

Fish are highly sensitive organisms to biochemical alterations in the aquatic environment; therefore, the physiological condition of fish – especially the activity of liver enzymes – can be used to assess the degree of ecosystem pollution. The liver serves as the primary detoxification organ in fish, where biotransformation of toxicants, antioxidant defense mechanisms, and metabolic stability are maintained. Consequently, changes in liver enzyme activity provide valuable information about anthropogenic impacts on the aquatic environment.

**Aim of the study.** The aim of this study is to assess the pollution levels of aquatic ecosystems by determining the activity of liver enzymes in fish and to identify enzymatic changes associated with exposure to environmental contaminants.

**Materials and methods.** In the experiments, the activity of alanine aminotransferase (ALT), aspartate aminotransferase (AST), superoxide dismutase (SOD), catalase (CAT), and glutathione-S-transferase (GST) was determined in liver samples collected from fish inhabiting various water bodies. Enzyme activities were measured using biochemical colorimetric methods. Concentrations of heavy metal ions in water samples (Fe, Cu, Zn, Pb, Cd) were quantified by atomic absorption spectroscopy. The obtained data were statistically analyzed and compared between relatively clean and polluted water bodies.

**Results and discussion.** The results of the study demonstrate that fish residing in relatively clean water bodies exhibit liver enzyme activity within physiological limits. However, in fish exposed to polluted waters, significant increases were observed in the activities of ALT and AST, indicating hepatocellular damage. At the same time, the activity of antioxidant defense enzymes – SOD and CAT – initially increased as a compensatory response, but subsequently decreased under conditions of high pollution levels. This decline indicates the intensification of oxidative stress and enhanced lipid peroxidation processes.

Furthermore, the activity of GST increased in the presence of organic toxicants, reflecting the activation of the organism's detoxification mechanisms. These alterations were found to correlate directly with the chemical burden of the aquatic environment.

**Conclusion.** The activity of liver enzymes in fish represents an effective biochemical indicator of aquatic ecosystem pollution. Enzymatic alterations enable early detection of heavy metals, pesticides, and organic toxicants in the water environment. Therefore, regular monitoring of liver enzyme activity in fish is essential as a component of ecological surveillance systems. This approach is not only useful for assessing the current condition of water bodies but also holds practical importance in developing strategies to maintain ecological safety.

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