

Abstract

Ecotoxicological Effects of Polystyrene Particles on *Cyprinus carpio*: A Laboratory Assessment[†]

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Abstract: Global consumption has led to an increased and persistent plastic pollution in the aquatic environments. Due to their small size, plastic particles are omnipresent, affecting aquatic biota. Polystyrene is a synthetic polymer and one of the most widely used plastics. Its accumulation in the environment endangers the health of aquatic organisms. This study aims to investigate the acute (7 days) and chronic (75 days) toxicity of spherical polystyrene particles (20, 200, 430 µm) on *Cyprinus carpio* fish using OECD methodology. No mortality or behavioral changes were recorded after acute or chronic tests conducted on 1, 10, 100 mg/L polystyrene particles. Polystyrene showed bioavailability mainly through ingestion with food, causing weight loss in fish. Fish lots exposed to the polystyrene mix (particle sizes of 20, 200, 430 µm and 1.2 mg PS/L total concentration) showed changes in physiological indices but without major significance compared to control lots. After 75 days of chronic exposure of fish to a mix of polystyrene particles, organs were collected for sub-lethal effect investigation. Polystyrene was found to cause oxidative stress in fish organs. A very significant increase in the activity of the enzymes catalase and glutathione reductase, correlated with lipid peroxidation in gills, were observed. In the liver, catalase and glutathione S transferase activity increased, but there were no lipid peroxidation effects. Also, alanine transferase and aspartate transferase activity showed significant changes. Regarding the vitellogenesis initiated in the liver, vitellogenin activity increased by 40%. EROD activity saw a 20% increase compared to control fish, indicating stress enzyme expression. Instead, acetylcholinesterase showed significant inhibition (>80%) in the brain and muscle. The protein profile showed new stress protein expression compared to the control in the gills and liver. Based on the results of our study, the introduction of new regulations monitoring the accumulation of microplastics in surface water is an urgent matter.

Keywords: polystyrene; *Cyprinus carpio*; fish; oxidative stress; acute; chronic; toxicity



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