

Isolation, Characterisation and Preparation of Polyethylene terephthalate (PET) Microplastics and Its Nanotoxicity on Developing Zebrafish Embryo

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Abstract:

Microplastic pollution poses a significant threat to freshwater ecosystems, with polyethylene terephthalate (PET) emerging as one of the most prevalent types of polymers in aquatic environments. This study investigated the abundance of PET microplastics in the River Sutlej, Punjab, India, through comprehensive isolation, characterisation and its nanotoxicity assessment in zebrafish (*Danio rerio*) model. Water and freshwater fish gut samples were collected during seasonal sampling (Pre-monsoon and Post-monsoon) drives to evaluate the environmental contamination and bioaccumulation patterns. Isolated microplastics were characterised with Fourier transform infrared spectroscopy (FTIR) for polymer identification and field emission scanning electron microscopy (FESEM) for morphological analysis. Results confirmed PET is the dominant polymer type, exhibiting heterogeneous morphologies including fragments and fibers. To assess the biological impacts, zebrafish embryos were exposed to fluorescently tagged PET nanoplastics at graded concentrations of 10, 50, 100, and 200 ppm. Toxicological assessment indicated dose-dependent developmental abnormalities, including significant morphological deformities and altered hatching rates, demonstrating clear nanotoxicological effects. This study provides critical baseline data on PET microplastic contamination in the waterbody and its accumulation in the fish gut, contributing valuable insights for environmental risk assessment and pollution management strategies.

Keywords:

PET microplastics, nanotoxicity, zebrafish, River Sutlej, developmental toxicity.