

Fate and characterisation of microplastics pollution in high altitude rivers of mid-Himalayan region

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Himalayan regions are known for their freshwater ecosystem, however microplastics (MPs) are ubiquitous in every environment and became the critical environmental threat, yet its fate and characterisation in high altitude ecosystems remain poorly understood. This study investigates the distribution, transport, and transformation of microplastics of high-energy rivers. We hypothesise that sediments act as a temporary sink for MPs, facilitating their retention, transformation, and interaction with environmental contaminations.

To test this hypothesis, field samples from rivers were collected from 18 locations of Beas River and their tributaries and analysed using Raman spectroscopic, surface sensitive XPS and SEM-EDS techniques to determine the MPs abundance, composition, and chemical modification due to weathering. Established protocols were used to extract the microplastics from different sediment samples (sand, silt and clay). Due to high tourism and human activities, up to 219 items/g of MPs were found in dried sediment sample collected from highly polluted region and showed the prevailing types of MPs were red fragments in varying size ranges, which were mainly defined to be Poly (vinylidene fluoride-co-hexafluoropropylene) and polyethylene terephthalate. Abundance of MPs were found appeared to be higher in <75 µm sediment particles transported from higher altitude to lower altitude.

This study provides the novel insights into the fate of MPs in fragile mountain ecosystems and highlights the sediments as critical reservoir influencing pollutant mobility.