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Microplastic Storages in Riverbed Sediments: Experimental on the Settling Process and Its Deposits

Authors : Alvarez Barrantes, Robert Dorrell, Christopher Hackney, Anne Baar, Roberto Fernandez, Daniel Parsons

Abstract : Microplastic particles entering fluvial environments are deposited with natural sediments. Their settling properties can change by the absorption or adsorption of contaminants, organic matter, and organisms. These deposits include positively, neutrally, and negatively buoyant particles. This study aims to understand how plastic particles of different densities interact with natural sediments as they settle and how they are stored within the sediment deposit. The results of this study contribute to a better understanding of the deposition of microplastic particles and associated pollution in rivers. A set of 48 experiments was designed to investigate the settling process of microplastic particles in freshwater. The experimental work describes the vertical variation of cohesive and/or non-cohesive sediment versus microplastic densities in deposited sediment. The experiment consisted of adding microplastic particles, sediment, and water in a waterproof carton tube of a height of 24 cm and a diameter of 5 cm. The plastic selected is positively, neutrally, and negatively buoyant. The sediments consist of sand and clay with four different concentrations. The mixture of materials was shaken until is thoroughly mixed and left to settle for 24 hours. After the settlement, the tubes were frozen at -20 °C to be able to cut them and measure the thickness of the deposits and analyze the sediment and plastic distribution. The most representative experiments were repeated in a glass tube of the same size; to analyse the influences of current flows and depositional process. Finally, the glass tube experiments were used to study organic materials adsorption in plastic, settling the sample for four months. Defined microplastic layers were identified as the density of the plastic change. Preliminary results show that most of the positive buoyancy particles floated, neutral buoyancy particles form a layer above the sediment and negative buoyancy particles mixed with the sediment. The vertical grain size distribution of the deposits was analysed to determine deposition variation with and without plastic. It is expected that the positively buoyant particles are trapped in the sediment by the currents flows and sink due to organic material adsorption. Finally, the experiments will explain how microplastic particles, including positively buoyant ones, are stored in natural sediment deposits.

Keywords : microplastic adsorption process, microplastic deposition in natural sediment, microplastic pollution in rivers, storages of positive buoyancy microplastic particles
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