EFFECT MECHANISM OF SUSPENDED SEDIMENT ON THE SETTLING OF PLASTIC PARTICLES IN NATURAL WATERS (INVITED)

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Interactions between nano/microplastics and suspended sediment (SS) in natural waters are important for the environmental fate of plastic particles. This study investigated the effect of heteroaggregation between nano/microplastics and SS on the settling of aggregates. In NaCl solutions (0.05-0.5 M), large SS (100 to 500 μm in diameter) significantly increased the settling ratio of polystyrene nanoplastics (PSNPs) with an average diameter of 100 nm due to the formation of PSNPs-SS aggregates. The settling ratio of the heteroaggregates increased significantly when the NaCl concentration increased from 50 to 200 mM. This was primarily because higher ionic strength reduced the electrostatic repulsion between large SS and PSNPs, and subsequently increased the heteroaggregation rate. No obvious differences in settling ratios were observed in 200 or 500 mM NaCl solutions because the heteroaggregation entered the diffusion-controlled regime. However, in HA solutions (10-50 $mg \cdot L^{-1}$), the surface adsorption of HA on PSNPs and large SS reduced the heteroaggregation of PSNPs-SS and thus the co-settling ratio due to the steric hindrance according to the DLVO theory. In contrast, polyethylene microplastics (PEMPs) with diameters of 1.0-1.2 mm were found to always float on water surface (up to 8 months), even after addition of 500 $mg \cdot L^{-1}$ small SS (< 10 μm in diameter). Clearly, the heteroaggregation of PEMPs and small SS had minor effect on the settling of PEMPs due to the overwhelming boyanccy. These results provided new insight into the fate and distribution of nano/microplastics in aquatic environment, which affect the bioavailability of plastic particles in natural waters.