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# Kinetic and thermodynamic investigation of nanoplastic stability in aquatic environments

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The presence of nanoplastics in freshwater and ocean is an emerging concern, which indicates that understanding aggregation stability of nanoplastic is crucial for assessing their risk and transport in the aquatic environment. Here, we investigated the stability of polystyrene nanoplastics (PS NPs) under several aquatic components, such as natural organic matter and salt types (NaCl, $CaCl_2$, $LaCl_3$) as well as other inorganic colloids ($TiO_2$ and hematite) and microplastics. The critical coagulation concentrations of PS NPs were lower for $La^{3+}$ compared with those for $Na^+$ and $Ca^{2+}$ owing to the stronger electrostatic interaction as the driving force. The formation of heteroaggregates in binary systems was induced by the charge neutralization driven by the electrostatic interaction as well. However, natural organic matters increased the stability of PS NPs. In three natural waters, PS NPs were stable in river water and wastewater, but unstable in seawater. Overall, our findings contribute to improving the understanding of the behavior and interactions between nanoplastics and different water components in natural aquatic environments.