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The Impacts Of Hydraulic Conditions On The Fate, Transport And Accumulation Of Microplastics Pollution In The Aquatic Ecosystems

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Abstract : Microplastics (MPs; particles <5 mm) pollution is considered as a globally pervasive threat to aquatic ecosystems, and many studies reported this pollution in rivers, wetlands, lakes, coastal waters and oceans. In the aquatic environments, settling and transport of MPs in water column and sediments are determined by different factors such as hydrologic characteristics, watershed pattern, rainfall events, hydraulic conditions, vegetation, hydrodynamics behavior of MPs, and physical features of particles (shape, size and density). In the meantime, hydraulic conditions (such as turbulence, high/low water speed flows or water stagnation) play a key role in the fate of MPs in aquatic ecosystems. Therefore, this study presents a briefly review on the effects of different hydraulic conditions on the fate, transport and accumulation of MPs in aquatic ecosystems. Generally, MPs are distributed horizontally and vertically in aquatic environments. The vertical distribution of MPs in the water column changes with different flow velocities. In the riverine, turbulent flow causing from the rapid water velocity and shallow depth may create a homogeneous mixture of MPs throughout the water column. While low velocity followed by low-turbulent waters can lead to the low level vertical mixing of MP particles in the water column. Consequently, the high numbers of MPs are expected to be found in the sediments of deep and wide channels as well as estuaries. In contrast, observing the lowest accumulation of MP particles in the sediments of straights of the rivers, places with the highest flow velocity is understandable. In the marine environment, hydrodynamic factors (e.g., turbulence, current velocity and residual circulation) can affect the sedimentation and transportation of MPs and thus change the distribution of MPs in the marine and coastal sediments. For instance, marine bays are known as the accumulation area of MPs due to poor hydrodynamic conditions. On the other hand, in the nearshore zone, the flow conditions are highly complex and dynamic. Experimental studies illustrated that maximum horizontal flow velocity in the sandy beach can predict the accumulation of MPs so that particles with high sinking velocities deposit in the lower water depths. As a whole, it can be concluded that the transport and accumulation of MPs in aquatic ecosystems are highly affected by hydraulic conditions. This study provided information about the impacts of hydraulic on MPs pollution. Further research on hydraulics and its relationship to the accumulation of MPs in aquatic ecosystems is needed to increase insights into this pollution.

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