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Mechanisms of plastic microparticles retention by buffer zones with macrophytes

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Abstract. Environmental pollution by resistant to degradation microparticles of synthetic polymer materials (microplastics) is one of the growing global problems nowadays. At the same time, research on the behavior of plastic microparticles in the environment is only at an early stage, as well as the development of methods for preventing and regulating microplastic contamination of water bodies. For the first time in world scientific practice, the author proposed to use the barrier role of macrophytes for these purposes. A number of mechanisms directly and indirectly leading to the microplastic retention by macrophytes have been identified based on field and laboratory experiments with plastic microparticles with different polymer matrix (polyethylene, polystyrene, polyethylene terephthalate, polyester) and air-water and immersed vegetation, as well as plants with leaves floating on the water surface. According to the predominance of a particular physical process, these mechanisms can be combined into four groups: (1) The appearance of additional resistance to the movement of water and air masses. Change in the kinematic structure of water and air flows promotes slowing down the movement of microparticles, their sedimentation and retention by plants; (2) Decreasing the kinetic energy of wind waves and raindrops by thickets of macrophytes prevents repeated movement of already trapped microparticles; (3) Mechanical retention of plastic microparticles occurs as a result of the existence of irregularities in the structure of plants, sieve-like structures made of interweaving of stems and leaves, the bulk of plant litter, adhesion of plant surfaces and microparticles, which is enhanced by the sticky surfaces of the periphyton; (4) The attraction and adhesion of plastic microparticles to plants and to each other occurs as a result of the interaction of electric fields.

Keywords:

microplastics, macrophytes, contamination, water body, microparticle retention

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