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Formation of an inorganic membrane-enzyme system for environmental applications

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Microplastic (MP) pollution has emerged as one of today's most critical environmental issues. Due to various factors (crystallinity, hydrophobicity, volume ratio and functional groups), microplastics are able to interact with various pollutants, such as organic contaminants or heavy metals. MP particles are extensively dispersed across marine environments, living organisms, and terrestrial ecosystems, causing harm to the entire environment. Membranes are the most effective method for the physical separation of microparticles, and enzymatic treatment enables the removal of contaminants under mild conditions, which is particularly important for research on microplastics. Environmental scientists are developing new sample preparation procedures that allow for the effective separation of polymers of various shapes and sizes present in the environment [1-2]. The aim of the work was to produce inorganic membranes that served as matrices for enzymes from various catalytic groups, creating biologically active systems. When producing membranes for microplastic filtration, the selection of appropriate materials was important. The use of petroleum-derived polymers was excluded due to possible sample contamination. It was conjectured that membranes would be made of low molecular weight chitosan and polylactic acid, which was to stabilize the membrane. The membranes were produced by electrospinning. Further, they served as matrices for enzymes immobilization e.g. protease, lipase, cellulase and laccase, as well as their systems. This led to the creation of biologically active membranes of designed properties for environmental sample filtration and purification before microplastic particle analysis.

References

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