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Enzymatic membrane reactors as versatile tools for sample preparation in the analysis of new micropollutants

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Microplastic particles are known for their low biodegradation rate and mostly remain in the environment adversely affecting the entire ecosystems and the human body [1]. Although the removal of microplastics is a final global goal, the first step is the development of standardized methods for monitoring the occurrence, distribution, and movement of microplastics in the environment. For this reason, a series of research has been initiated to determine the effect of various substances and procedures on microplastic analysis and to develop universal protocols for the removal of co-contaminants for effective microplastic examination [4]. Nevertheless, the challenge is to propose a one-pot approach for sample purification and further analysis with limited negative effects on microplastic structure. Hence, the main goal of the presented study is to develop a multienzymatic biomembrane composed of enzymes from various catalytic groups, for use in enzymatic membrane reactors for sample purification prior to microplastic analysis. As a main component of the system, gold- and aluminium-coated polyester membranes served as the support material for enzymes such as cellulase, lipase, protease, and laccase deposition. These enzymes are capable of removal of the most common impurities including cellulose, lipids and oils, peptides, and biomass residues. Within the presented research the most suitable conditions for membrane preparation were determined and enzymes immobilization order was examined to retain high catalytic properties and ensure efficient sample purification. After obtaining, membranes were thoroughly characterized to evaluate their physicochemical and morphological properties and were finally tested in the removal of model impurities affecting microplastic analysis.

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