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Application of aluminium-coated membranes for the immobilization of enzymes: model reactions for the evaluation of enzyme activity

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Aluminum-coated membranes are employed to identify and characterize micro- and nanoparticles in natural waterways, marine life, and consumer products such as mineral water and other beverages. The potential environmental and toxicological effects of these micropollutants are becoming a significant global concern [1]. The most problematic contaminants in environmental samples are cellulose and protein. Within the presented study, enzymes that are specifically designed to degrade these co-contaminants were immobilised on aluminium-coated membranes to create biologically active membranes for the purpose of one-step enzymatic sample treatment and filtration. Subsequently, other enzymes, such as lipase, and laccase, were subjected to testing. The resulting biomembranes were subjected to a comprehensive characterisation, during which their kinetic parameters were determined under a range of conditions. The catalytic activity retained by the lipase after immobilization was defined on the basis of a model reaction for the hydrolysis of para-nitrophenyl palmitate (p-NPP) to para-nitrophenol (p-NP) and palmitic acid [2]. The catalytic activity of free and immobilized cellulase was evaluated by measuring the quantity of reducing sugars (glucose) during hydrolysis of the cellulose substrate. The concentration of glucose was quantified using the DNS method [3]. The activity of the free enzyme and the laccase immobilized onto the biocatalytic membranes was calculated from spectrophotometric measurements during continuous monitoring of the ABTS oxidation reaction [4]. Moreover, the procedure described by Hagihara et al. using casein as the substrate to measure protease activity was followed [2]. The performed model reactions enabled comparison of the properties of created biocatalytic systems.

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