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Bioinspired Se-driven Switchable Microgel Catalysts for Oxidation Processes

Initiative: Trilaterale Partnerschaften – Kooperationsvorhaben zwischen Wissenschaftler(inne)n aus der

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Inspired by selenocysteine enzymes it is planned to synthesize Se-modified aqueous microgels, understand their internal structure and behavior at interfaces and to demonstrate their catalytic activity in oxidation of aldehydes as model reaction. Stimuli-responsive aqueous polymer microgels with integrated catalytically active Se-containing functional groups will be synthesized by varying different microgel parameters like chemical composition, crosslink density and structure/amount of Se-units to mimic the structure of selenocysteine enzymes. Microgels decorated by Se-units will be used as colloidal surfactants to stabilize oil-water emulsions what ensures their spreading and localization at the interface between two immiscible liquids. The unique highly porous amphiphilic microgel structure makes them permeable for hydrophilic and hydrophobic small organic molecules (solvents, reagents) and this ensures compatibility of immiscible liquids and accessibility of the Se-catalytic centers at the interface from both organic and aqueous phases providing high reactivity. The responsiveness of microgels to temperature or pH reflected in the change of the microgel swelling degree allows regulation of the diffusion processes at the interface, thus influencing the reaction rate. Catalytically active microgels positioned at the interface of the oil droplets will be used to catalyze the oxidation or oxidative alkoxylization of aldehydes (droplets) mediated by H2O2 (water) with expected benefits like high reaction rates at lower H2O2 concentrations, mild reaction conditions, simple separation of reaction products, and recovery of the microgel catalyst. In this manner a toolbox for tailor-made synthetic enzyme-mimicking Se-modified microgel catalysts will be designed that can be used for various oxidation processes.

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