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Immobilization of urease on magnetic nanoparticles

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Special interest recently has been revealed to magnetically directed sorbents, primarily the magnetite derived ones. It turned out that, using hydrolytic polycondensation reactions with alkoxysilane precursors it is possible to deposit on the surface of magnetic nanoparticles a polysiloxane layer incorporating the functional groups required for fixation of enzymes. Moreover, the creation of the polysiloxane layer on the surface of magnetite particles and the enzyme immobilization can be carried out simultaneously using the above-mentioned reaction. This approach opens opportunities to approach a new generation of composite biocatalysts, combining the advantages of silica supported enzymes with the easy directability and facile handling typical of magnetite.

Therefore, the aim of the present work was to evaluate the approaches to obtaining magnetically controlled biocatalysts based on urease. In this case, the reaction of the hydrolytic polycondensation of trifunctional silanes (as functionalizing agents) and tetraethoxysilane (as structuring agent) allows the creation of mono- and bifunctional layers on the surface of Fe_3O_4 nanoparticles containing amine, ethylenediamine, thiol, amine/alkyl and thiol/alkyl groups. Comparison of the binding efficiency and the activity of the immobilized enzyme permits identification of covalent bonding as the most promising approach for creation of a magnetically retrievable formulation (96% binding together with 75% residual activity), especially if biomedical applications such as dialysis are the principal aim. All formulation components are biocompatible, making both biomedical and environmental applications of produced materials feasible.

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