

"Nanotechnology and nanomaterials"

Cyclic carbonate groups for biomolecules immobilization at low temperature

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Surface-initiated, atom-transfer radical polymerization (SI-ATRP) is used for formation of polymer brushes on solid supports from the ATRP initiator that is attached onto a matrix [1]. A novel support material with polymer brushes was developed for facile enzyme immobilization biological macromolecules at low temperature without any modification or activation steps. In the first step, magnetic poly(hydroxyethylmethacrylate–ethylene glycol dimethacrylate) beads were prepared via suspension polymerization in the presence of Fe(III) ions and grafted with polymer brushes (i.e., glycidylmethacrylate; p(GMA)) via SI-ATRP, then epoxy groups of the p(GMA) were converted into vinylene carbonate groups under CO₂ atmosphere. The mp(HEMA/EGDMA)-g-p(GMA)-SC was characterized by SEM, FTIR, XRD and elemental analysis. The synthesized support was used for immobilization of tyrosinase enzyme, and then tested for removal of nitrophenols from aqueous solution. The amounts of immobilized enzyme onto the vinylene carbonate groups generated beads were found to be 31.4 mg/g. Optimum temperature and pH for free tyrosinase were 30 °C and 5.5 whereas for immobilized enzyme was 35°C and 6.5. The K_m value was increased about 1.7 folds compared to free enzyme. Whereas V_{max} value was decreased about 2.1 fold upon immobilization. The mp(HEMA/EGDMA)-g-p(GMA)-SC-Enz beads were used for degradation of phenol, *p*-nitrophenol and 2,4 dinitrophenol in a continuous system. At 50 ppm phenolic compounds for 2 h reaction period more than 63% degradation was observed. The degradation order of phenolic compounds is phenol > *p*-nitrophenol > 2,4 dinitrophenol. For 48h phenol degradation time, the immobilized enzyme preserved its initial activity upto %69 in continuous system.

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2. Bayramoglu G., Arica M.Y., Reversible immobilization of tyrosinase onto PEI grafted Cu(II) chelated p(HEMA-co-GMA) reactive membranes // J Mol Catal B. -2004 -**27**, -P. 255-265.