ABSTRACT

Transition state analogue imprinted polymeric catalysts with and without vinyl functionalized MWCNT for the hydrolysis of p-nitrophenyl esters of Z-L-phenylalanine were prepared by bulk polymerisation method. For comparing and evaluating imprinting efficiency, non-imprinted polymers were also prepared. The synthesised functional monomer, transition state analogue and the enzyme mimic were analysed using various spectroscopic techniques like FT-IR and 1H NMR. Scanning electron microscopy and TEM were used for studying the surface morphology of the imprinted and non-imprinted polymers. Emphasis is given to the design of an effective catalyst by changing the nature and extent of crosslinking, porogen, copolymer composition with different functional groups for enhancing catalytic activity, and metal coordination during the prepolymerisation stage. Catalytic activities of the imprinted, non-imprinted polymers and uncatalysed reaction were carried out using the UV-vis. spectroscopic method and the kinetics of the reaction follows pseudo-first order kinetics. The substrate selectivity and enantioselectivity of the imprinted polymers evaluated towards structurally related esters and enantiomers. The hydrolytic conditions were optimised by changing the pH and solvent ratio of the reaction medium. Incubation studies of the enzyme mimic was also conducted. Low cost, ease of preparation, high thermal stability, reusability and higher shelf life make the enzyme mimics economic. The results indicated that by imprinting a transition state analogue of the amino acid ester an effective catalyst could be synthesised and applied for the specific and selective catalysis of the corresponding amino acid ester.

Keywords: MWCNT, molecular imprinting, transition state analogue, chymotrypsin mimic, hydrolysis, amino acid ester, cooperative effect, memory effect, enantioselectivity, metal ion coordination.