Preparation of a Salt-Responsively Soluble-Insoluble Enzyme and Its Application to Hydrolysis of Biomass

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Summary

A copolymer of glycidyl methacrylate (GMA) and N-isopropylacrylamide (NIPAM) forms a salt-responsively soluble-insoluble polymer (GMA-NIPAN), whose solubility changes with the NaCl concentration of the solution. An amylase (Dabiase) was immobilized on GMA-NIPAN (D-GN) for saccharification of soluble starch was 90% that of native Dabiase and higher than that of conventional solid immobilized enzymes. D-GN was soluble below 32℃ but insoluble above 44℃. When NaCl was added to a buffer solution (pH 5.0) with D-GN, the solubility response of D-GN to a change in temperature was more sensitive than that in the buffer solution without NaCl. In addition, the temperature causing half of the maximum turbidity decreased by about 2.3℃ whenever the NaCl concentration of the buffer solution was increased by 1%. D-NG was used successively for repeated hydrolysis of soluble starch, in which D-GN was insolubilized not only by adjusting the NaCl concentration of reaction mixture to 4% at 30℃, but also elevating the temperature of reaction mixture with 1% NaCl from 30℃ to 38℃, following by its batchwise recovery from a reaction product by centrifugation.