77c Biocatalysis and Co_2-Induced Separation and Recycle in Organic-Aqueous Tunable Solvents (Oats)

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Enzymes are attractive catalysts for use in industrial reactions because they function optimally at relatively mild temperatures and pressures and often exhibit high enantioselectivity. Though most enzymes have evolved to function best in aqueous media, many potential prochiral substrates are more soluble in organic solvents. In order to enzymatically transform these substrates, it becomes necessary to use a partially organic reaction medium that assures substrate solubility but does not severely decrease enzyme activity. Moreover, a monophasic reaction mixture is desirable so that enzyme and substrate can contact each other with out the barrier of a phase boundary. We have investigated the use of enzymes in Organic-Aqueous Tunable Solvent (OATS) mixtures consisting of an aqueous buffer and a water-miscible organic solvent. In addition to improving substrate solubility, our OATS mixtures have the added advantage that the aqueous and organic components are easily separated from the monophasic reaction mixture after reaction by the addition of moderate CO_2 pressure. The separate phases can then be sent for further processing and catalyst recycle.

For this initial "proof of concept" evaluation of biocatalysts in recyclable OATS systems, we have tested the applicability of using Candida Antarctica lipase B (CALB) for the hydrolysis of several water-insoluble esters in OATS systems using acetonitrile or dioxane as solvent. Reaction rates of this enzyme and substrate conversion in the OATS mixtures will be presented. The addition of moderate CO_2 pressure was used to separate the reacted OATS mixture and product partitioning between the phases will be reported. Recycle performance of the aqueous portion containing the enzyme for further reaction cycles will also be evaluated.