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Enhancement in reaction rate and product selectivity of organic reactions in water using micellar catalysis

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Abstract

The water is an inexpensive green solvent and is used to establish ecofriendly processes for the synthesis of chemicals. The water plays co-catalytic activity in many organic reactions [1]. In addition, the water as solvent is helpful in easy separation and reuse of catalysts (which are generally water soluble) from the reaction mixture [2]. However, the poor solubility of most of the organic reactants in water is the major constrain of the synthesis in water, i.e., biphasic reactions. The biphasic reactions are very slow due to less interfacial area between organic and aqueous phases. The aqueous solutions of surfactants (micellar solutions) are effective to promte the reaction rate and product selectivity of organic reactions in water [3-5]. The enhancement in reaction rate and selectivity of organic reactions in water using surfactants (micellar solutions) is known as micellar catalysis. The micellar catalysis can play a foremost role in the development of environmentally benign processes avoiding the use of organic solvents, high temperature, decay of catalyst, side reactions, etc.

The talk is aimed to show the potential of micellar catalysis for green synthesis of chemicals. The effect of important factors influencing the micellar catalysis and the mechanistic aspects of the micellar catalysis will be discussed. The increased solubility of water insoluble reactant(s) with the help of micelles in aqueous phase, increased interface, high concentration of ionic or water soluble reactant near micellar surface due to surface charge, and co-catalytic activity of surfactant molecules collectively enhance the reaction rate in micellar catalysis. The micellar catalysis also makes the reactions selective to a desired product by orienting the reactant(s) molecules in the micelles. Our studies show that the nature (head group charge, size and chain length) and the concentration of surfactants significantly influence the micellar catalysis. The spectroscopic studies reveal the vital role of surfactant-substrate interactions in promotion of the micellar reactions. The important aspects of green chemistry like separation of product and catalyst, recyclability of micellar solution, etc. will also be discussed.

Biography

Dr. Manish Kumar Mishra has been Associate Professor in Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar, Gujarat. Dr. Manish Kumar Mishra completed his PhD in heterogeneous catalysis from Discipline of Inorganic Materials and Catalysis, CSIR-Central Salt and Marine Chemical Research Institute (CSIR) Bhavnagar (India). He worked as an Assistant Professor at Dharmsinh Desai University, Nadiad, Gujarat. He had published 49 papers and owned 3 patents. After that he was awarded with Achiever's Award (in research) for the year 2013-14 by D.D. University Alumni Association; Dr. D.O. Shah Research Excellence Award 2013 by Shah-Schulman Centre for Surface Science and Nanotechnology, D. D. University, Nadiad, Gujarat. He is a Member of Society for Materials Chemistry, Catalysis Society of India, and American Chemical Society.

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