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Role of cetyltrimethylammonium bromide (cationic surfactant) on the tryptophan-MnO₄⁻ reaction

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Abstract

Upon addition of permanganate to a solution of tryptophan (Trp), yellow-brown color species appears within the time of mixing of tryptophan in absence and presence of cetyltrimethylammonium bromide (CTAB), which was stable for some days. Spectroscopic and kinetic evidences suggest the formation of water-soluble colloidal MnO₂ as the most stable reduction product of MnO₄⁻. Carbon dioxide and ammonia are not formed as the oxidation products. Carbon-carbon double bond of indole moiety of Trp is responsible for the fast reduction of permanganate. Cetyltrimethylammonium bromide catalyses the permanganate oxidation of Trp with a rate enhancement of ca. 200-fold. Sub- and postmicellar catalytic effect of CTAB ascribed to the association/incorporation/solubilization of both reactants (MnO₄⁻ and Trp) with the CTAB aggregates and into the Stern layer of cationic micelles. Quantitative kinetic analysis of the rate constant-[CTAB] data has been performed on the basis of modified pseudo-phase model of the micelles. A comparison was made of the oxidation rates of different amino acids by permanganate. The order of the effectiveness was as follows: tryptophan » tyrosine » phenylalanine. © 2009 Elsevier B.V. All rights reserved.

Author Keywords

Catalysis; CTAB; MnO₄⁻; Oxidation; Surfactants; Tryptophan

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