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ORIGINAL ARTICLE

Micellar and salt kinetic effects upon the reaction $MnO_4^- + EDTA$

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Abstract Conventional UV–visible spectrophotometric technique was used to study the kinetics of oxidation of ethylenediaminetetraacetic acid (EDTA) in presence and absence of cationic micelles of cetyltrimethylammonium bromide (CTAB) by MnO_4^- in alkaline medium. The reaction follows first-order kinetics with respect to each $[MnO_4^-]$ and $[OH^-]$ in both media. The plots of log absorbance versus time clearly indicate that the oxidation process has an induction period followed by autoacceleration (sigmoid behaviour). The extent of the induction period depends on the experimental conditions. The rate constants increase with increasing [CTAB]. The observed catalytic effect has been discussed in terms of the incorporation/association/solublization of MnO_4^-, reactive species of EDTA and OH^- into the Stern layer by using Menger–Portnoy model. The presence of NaCl and NaBr inhibits the reaction rate due to the exclusion of reactant from the Stern layer. On the bases of the observed results, the mechanism has been proposed and discussed.

1. Introduction

Surfactants of cationic nature like CTAB are well known as antibacterial compounds. They are used as environmental cleaning products, cosmetic formulations and pharmaceuticals. The special properties of surfactants are important in a wide variety of applications in chemistry, biology, engineering, material science, photochemical, photobiological solar energy conversions and other areas (Fendler, 1985). These molecules are said to be amphipathic, i.e., they have distinct hydrophilic (polar) and hydrophobic (non polar) regions (Alexandridis and Hatton, 1995). Surfactants dissolve completely in water at very low concentrations, but above a certain level, the critical micelle concentration (CMC), the molecules form globular

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