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Oxidation of tyrosine by permanganate in presence of cetyltrimethylammonium bromide

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ABSTRACT

In this paper we report the effect of cetyltrimethylammonium bromide, CTAB on the oxidative degradation of tyrosine by permanganate. The reaction rate bears a first-order dependence on the [MnO₄⁻] under pseudo-first-order conditions (large excess of [tyrosine] for at least 10 times over [MnO₄⁻]) in presence of 10.0 × 10⁻⁴ mol dm⁻³ CTAB. The effect of total [CTAB] on the reaction rate was determined. When [CTAB] was less than its critical micelle concentration (CMC) the rate constants (*k_{obs}*) values decreased from 18.5 × 10⁻⁴ to 7.2 × 10⁻⁴ s⁻¹. As the [CTAB] was greater than the CMC, the *k_{obs}* values increase from 7.2 × 10⁻⁴ to 15.8 × 10⁻⁴ s⁻¹ at room temperature. The pre-micellar environment of CTAB strongly inhibits the reaction rate where as increase in rate constant ascribed to the incorporation of tyrosine and MnO₄⁻ in to the Stern layer of CTAB micelles. The reaction has acid-dependent and acid-independent paths and, in the former case, the zero-order kinetics with respect to [H₂SO₄] shifted to fractional-order at higher [H₂SO₄]. Experiments have been done to confirm the nature of Mn(IV) formed during the reduction of permanganate by tyrosine. The mechanism with the observed kinetics has been proposed and discussed. The presence of -OH group is responsible for the higher reactivity of tyrosine which easily transfers the proton to MnO₄⁻.