

Kinetics of Ir(III)-Catalysed Oxidation of Ampicillin by $\text{Cu}(\text{Bip})_2^{2+}$ in Alkaline Medium: A Spectrophotometric Study

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Abstract:Kinetics and mechanism of Ir(III)-catalyzed oxidation of ampicillin by $\text{Cu}(\text{Bip})_2^{2+}$ in alkaline medium was studied at $35 \pm 0.1^\circ\text{C}$. First-order kinetics with respect to $[\text{Cu}(\text{II})]$, $[\text{Ir}(\text{III})]$ and $[\text{OH}^-]$ throughout their variation were observed. The reaction shows fractional positive order kinetics in [Ampicillin]. Nil effect of [bipyridyl] on the rate of oxidation by $\text{Cu}(\text{Bip})_2^{2+}$ was observed. The reaction also shows slight increase in the rate by decreasing dielectric constant of the medium and remains unaffected by the change in ionic strength of the medium. The reaction was studied at four different temperatures and observed values of rate constants were utilized to calculate various activation parameters specially the entropy of activation (ΔS^\ddagger). $\text{Cu}(\text{Bip})_2^{2+}$, ampicillin as such and $[\text{IrCl}_3(\text{H}_2\text{O})_2\text{OH}]^-$ have been assumed as the reactive species of Cu(II), ampicillin and Ir(III) chloride in alkaline medium, respectively. With the help of the observed kinetic orders with respect to the reactants involved in the reaction, spectrophotometric evidence collected for the formation of reactive complexes and the positive entropy of activation, a most probable reaction mechanism for the oxidation of ampicillin by $\text{Cu}(\text{Bip})_2^{2+}$ in alkaline medium using Ir(III) as homogeneous catalyst has been proposed.

Key words: Ampicillin, copper-bipyridyl complex, catalysis, spectrophotometric study, alkaline medium.

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