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Catalytic Activity of Os(VIII) on the Oxidation of Sulfadiazine with Alkaline Chloramine-T: Kinetic and Mechanistic Chemistry

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ABSTRACT

Sulfadiazine [SD: 4-amino-N-(2-pyrimidinyl) benzenesulfonamide] is a sulfonamide antibiotic and is commonly used to treat urinary track infections. Literature survey revealed that there are no efforts being made from the kinetic and mechanistic viewpoints of this drug and also no one has examined the role of platinum group metal ions as catalyst for the oxidation of SD drug. The chemistry of chloramine-T (CAT) has evinced considerable interest due to its diverse behavior. For these reasons, we have taken up a systematic kinetic study on the oxidation of SD drug with CAT in aqueous alkaline medium catalyzed by Osmium tetroxide (Os (VIII)) at 303 K in order to unfold the mechanistic picture of this redox system. The reaction shows a first-order dependence of rate each on $[CAT]_o$ and [Os(VIII)], and less than unity order dependence on both $[SD]_o$ and [NaOH]. The reaction was subjected to changes in (i) ionic strength, ii) NaCl and iii) p-toluenesulfonamide, and the effect of these on the rate of the reaction have been investigated. The reaction fails to induce the polymerization of acrylonitrile. The reaction was studied at different temperatures and activation parameters have been evaluated. Oxidation products were identified by GC-MS analysis. Os(VIII) catalyzed reaction was found to proceed about nine-fold faster than the unanalyzed reaction and hence it justifies the use of Os(VIII) catalyst in the present redox system. The observed results have been explained by a plausible mechanism and the related rate law has been formulated.

Keywords: Chloramine-T, Sulfadiazine, Os (VIII) catalysis, Oxidation-kinetics, Mechanism.