

# Mechanistic studies of oxidation of substituted oxoacids by IFC in the presence of 1,10-phenanthroline

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## ABSTRACT

The catalytic activity of 1,10-phenanthroline (phen) in imidazolium fluorochromate (IFC) oxidation of 4-oxo-4-phenyl butanoic acid (4-oxo acids) has been studied in 50% acetic acid-50% water medium. The reaction is first order each in imidazolium fluorochromate, oxo acid and hydrogen ion concentration. The rate of the reaction has been conducted at five different temperatures. Thermodynamic parameters have been calculated. A good correlation is found to exist between  $\log k_1(308K)$  and Hammett constant( $\sigma$ ). For substituted oxoacids, the electron withdrawing substituents retard the reaction rate, while the electron releasing substituents enhance the rate of the reaction. The order of reactivities with substituents is  $p\text{-CH}_3\text{O} > p\text{-CH}_3 > p\text{-C}_6\text{H}_5 > \text{H} > p\text{-Cl} > p\text{-Br} > m\text{-NO}_2$  is due to the presence of +I and -I effect. The Exner plot  $k_2(313\text{ K})$  versus  $k_2(318\text{ K})$  is linear and isokinetic temperature is obtained. This supports that all the reactions under this investigation follow a common mechanism. The constant  $\Delta G$  values are obtained for all the substituted compounds. It also indicates that the substituted compounds are oxidized by same mechanism. Benzoic acid has been identified as the corresponding product of oxidation. Based on the kinetics results, a suitable mechanism has been proposed.

**Key words:** Imidazolium fluorochromate – oxoacids – Kinetics – oxidation.