

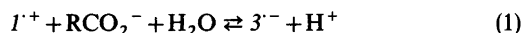
## Short Communications

### The Mechanism of the Decomposition of Chlorpromazine Cation Radical in Aqueous Buffers

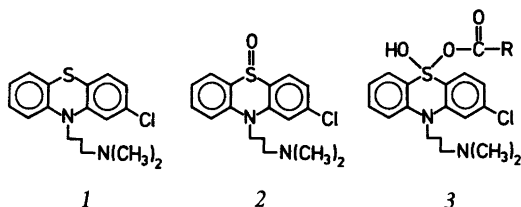
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A very complex mechanism with poorly defined intermediates has recently been proposed for the decomposition of chlorpromazine cation radical  $I^{\cdot+}$  in aqueous buffer solution.<sup>1</sup> The product of the reaction in acidic buffers was observed to be the oxide 2. The feature of the postulated mechanism which we find to be unacceptable is reaction (1) which is formally a reaction of a cation radical with



a carboxylate ion and hydroxide ion to give an anion radical. The mechanism proposed, in contrast to that from a similar study on the hydroxylation of thianthrene cation radical,<sup>2</sup> is consistent with the observed rate law. We have attempted to formulate

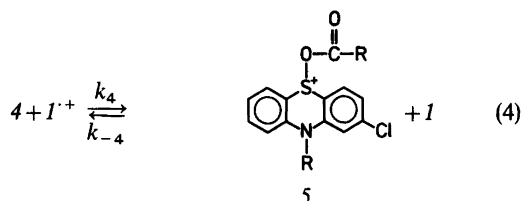
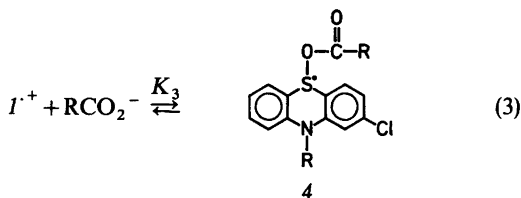


reasonable structures of anion radical  $3^{\cdot-}$  without success. The purpose of this note is to point out that a reasonably simple mechanism, not requiring any unusual structural features fits the observed kinetics.

The rate law observed for the decomposition of  $I^{\cdot+}$  to 2 is of the form of eqn. (2). The concentration of water was also included in the rate law<sup>1</sup> but

$$\text{Rate} = k_{\text{app}}[I^{\cdot+}]^2[\text{RCO}_2^-]/[\text{H}^+](A[I] + B) \quad (2)$$

since the experiments were in aqueous solution this is not experimentally justifiable. The constants A and B come from correlation of the observed rate constant with the concentration of 1. The features of the rate law which differ from the general rate law observed for cation radical reactions with nucleophiles<sup>3–7</sup> are the concentrations of  $\text{RCO}_2^-$  and  $\text{H}^+$  which must be taken into account in formulating a mechanism. The obvious possibility which was not considered is reaction (3) in equilibrium followed by reaction (4) then equilibrium (5) and finally product forming reaction (6).

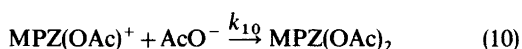
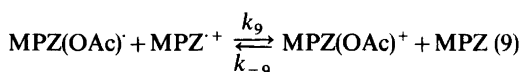


Rate law (7) is obtained by applying the steady state approximation on intermediate 5 and making the reasonable assumption that  $k_4[4][I^{\cdot+}] \gg k_{-5}[3][\text{H}^+]$ . The latter assumption is surely reasonable

$$\text{Rate} = 2 k_6 K_3 K_4 K_5 [I^{\cdot+}]^2 [\text{RCO}_2^-] / [\text{H}^+] ([I] + k_5/k_{-4}) \quad (7)$$

since the concentrations are expected to be of comparable magnitude and  $k_4$  is expected to be very much greater than  $k_{-5}$ . Furthermore, it was only necessary to make this assumption in order for the rate law to be *identical* in form to that proposed earlier.<sup>1</sup>

We have recently obtained very strong support for the mechanism that we are proposing for the decomposition of  $I^{++}$  in aqueous buffer solution. The cation radical of 10-methylphenothiazine (MPZ) undergoes reaction with acetate ion in aqueous acetonitrile by mechanism (8)–(10).<sup>8</sup> The acetate moieties in all of the intermediates are considered to be bonded to sulfur. The kinetics are



somewhat more simple in this case since the nucleophilic attack in reaction (10) is observed kinetically while the comparable reaction with water (5) cannot be detected in aqueous media.

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