

## Ionic Strength Effects on the Oxidation of Vitamin C

K.V.M. Udayakanthi\* and K.R. Fernando†

*Department of Chemistry, Faculty of Science, University of Ruhuna*

### Abstract

The kinetics of the reaction between vitamin C, L-ascorbic acid, and hexacyanoferrate (III),  $\text{Fe}(\text{CN})_6^{3-}$ , in aqueous acidic media at different temperatures has been studied by following the absorbance with time at 420 nm. The mechanism of the oxidation of L-ascorbic acid had been proposed to be multi-step and the rate determining step was between ascorbate anion, which would be produced in the initial reversible step, and hexacyanoferrate (III). This reaction has been well established to be first order with respect to L-ascorbic acid and  $\text{Fe}(\text{CN})_6^{3-}$ . The overall second order rate constant,  $k_{\text{obs}}$ , was observed to show an inverse dependence on  $[\text{H}^+]$  for the range of pH studied at temperatures from 293 to 313 K. In this study  $k_2$ , the rate constant for the rate-determining step, was determined by its relationship to  $k_{\text{obs}}$ , the experimentally measured overall rate constant, at various temperatures and different concentrations of  $\text{NaNO}_3$ . The experimental value for  $k_2$  was found to vary from 52.6 to 202  $\text{dm}^3 \text{mol}^{-1} \text{min}^{-1}$  when  $\text{NaNO}_3$  concentration was changed from zero to 0.200  $\text{mol dm}^{-3}$  at 302 K. The effect of ionic strength on the kinetics of this reaction was investigated by substituting  $\text{NaNO}_3$  with  $\text{KNO}_3$ ,  $\text{K}_2\text{SO}_4$ ,  $\text{NaCl}$ ,  $\text{KCl}$ ,  $\text{Na}_2\text{SO}_4$ ,  $\text{MgCl}_2$ ,  $\text{MgSO}_4$ ,  $\text{Mg}(\text{NO}_3)_2$ ,  $\text{Al}_2(\text{SO}_4)_3$  and  $\text{Al}(\text{NO}_3)_3$ . It was deduced by the primary kinetic salt effect, that the rate determining step involved species of like charges. Thermodynamic parameters of activation at different ionic strengths were calculated by using the Eyring equation.

**Keywords:** *entropy of activation, ionic strength, rate-determining step, reaction mechanism.*

\* [mudayakanthi@gmail.com](mailto:mudayakanthi@gmail.com)

† [rodney@chem.ruh.ac.lk](mailto:rodney@chem.ruh.ac.lk)