SELF-DIFFUSION OF $\text{Co}^{2+}$ IONS IN $\text{CoSO}_4$ IN AGAR GEL MEDIUM: CONCENTRATION DEPENDENCE OF OBSTRUCTION EFFECT AND ACTIVATION ENERGY

S.F. Patil, N.G. Adhyapak, S.N. Patel

Department of Chemistry, University of Poona, Pune - 411 007, India

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The obstruction effect and activation energy for the self-diffusion of $\text{Co}^{2+}$ ions in $\text{CoSO}_4$ have been computed using the zone-diffusion technique in agar gel medium at five different concentrations of the electrolyte. Both parameters are found to decrease with an increase in electrolyte concentration. The decrease in obstruction effect expressed in terms of $\alpha$ is attributed to the competitive hydration between ions and agar molecules in a diffusion system while the decrease in activation energy is explained by considering the changes in the physical properties of the solution with concentration at microscopic level.

INTRODUCTION

The effect of electrolyte concentration on the diffusion coefficient, obstruction effect and activation energy has been reported by us in various systems$^{1-6}$. The present paper deals with the determination of the obstruction ef-
fect and activation energy for the self-diffusion of $\text{Co}^{2+}$ ions in $\text{CoSO}_4$ using agar gel medium at various concentrations of cobalt sulphate.

EXPERIMENTAL

The obstruction effect in the self-diffusion of labelled $^{58}\text{Co}^{2+}$ ions in $\text{CoSO}_4$ was determined at 25 °C by varying the gel concentration between 1 to 2.5% while the activation energy was determined in 1% agar gel over a temperature range of 25-50 °C. The concentration of the electrolyte during the estimation of these parameters was varied between $10^{-5}$ and $10^{-1}\text{M}$ and the diffusion coefficients were measured using the zone-diffusion technique as described in our earlier paper.

RESULTS AND DISCUSSION

Obstruction effect

Figure 1. presents the obstruction effect in the self-diffusion of $\text{Co}^{2+}$ ions in $\text{CoSO}_4$ at five different concentrations of the electrolyte. Examination of this figure shows that the diffusion coefficient in gel medium $/D_g/$ decreases with increasing weight fraction of agar $/\omega/$ in agreement with our previous reports and the theory established by Thomas et al. The dotted lines in the figure indicate the extrapolation of diffusion coefficient to zero agar gel content $/D_s/$. The values of

$$\alpha \left( \frac{\text{Slope of } D_g \text{ vs. } \omega \text{ line}}{D_s} \right),$$

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