EFFECT OF CUSO$_4$ AND MNSO$_4$ ON THE REACTION RATE OF N-CHLOROPHTHALIMIDE WITH CYCLIC ALCOHOLS IN ACETIC ACID MEDIUM

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ABSTRACT

The effect of catalyst on the reaction of rate N-Chlorophthalimide with cyclic alcohols was carried out at 308 K. The follows pseudo first order kinetics each in [NCP] and [cyclic alcohols], and reaction is acid catalyzed. Oxidation reductions are very sensitive to metal catalyst. In order to study the effect of catalyst ions were chosen as CuSO$_4$ and MnSO$_4$ were taken as the cat ions sources of Cu$^{++}$ and Mn$^{++}$ ions. The effects of these ions were studied by adding varying concentration of Cu$^{++}$ and Mn$^{++}$ to the reaction mixtures, keeping the concentration of substrate, oxidant and composition of acetic acid water and temperature constant. Effect of CuSO$_4$ and MnSO$_4$ (catalyst) on the reaction of rate NCP with cyclopentanol, cyclohexanol and cycloheptanol were study in present study.

Key words: Involvement, consistent, composition, deterioration, catalyst

INTRODUCTION

Chemical kinetics is the branch of physical chemistry which concerns itself with the study of velocity of chemical reaction and with the elucidation of the mechanism by which they proceed. Thermodynamics considers how far a reaction will proceed. The study completely discarded the form at ion of complex and rules out involvement of cations. Catalytic oxidation methods, which employ a variety of metal-containing catalyst such as Cu(I)$^{1,2}$, Ni(II)$^{3,4}$, Co(II)$^{5,6}$, Pd(II) and manganese oxide$^{7,8}$ developed quickly in recent decades. However, most of the metal catalysts are expensive and may led to the environmental pollution with the overgrowing environmental and economic concerns the development of benign catalytic process for alcohol oxidation is becoming increasingly important.$^{9-11}$

EXPERIMENTAL

All the chemicals employed in this investigation were of analytical grade. The solution of N-chlorophthalimide was obtained by (99% purity) whose melting point was found to be 481$^0$K was obtained by dissolving its weighed quantity in 100% acetic acid and kept in either amber colored flask or black paper wrapped around it to save it from the action of diffused day light which alters appreciably its concentration i.e. to avoid occurrence of photochemical deterioration. Other solutions required in the study such as CuSO$_4$, MnSO$_4$, CH$_3$COOH, KI,
hypo \( \text{K}_2\text{Cr}_2\text{O}_7 \) acrylo nitrile prepared and standardized as laid methods prescribed in analytical chemistry.

**RESULTS AND DISCUSSION**

Redox reaction is very sensitive to metal ion catalysts. In order to study the effect of catalyst \( \text{Cu}^{++} \) and \( \text{Mn}^{++} \) ions were chosen. The effects of these ions were studied by adding varying concentration of \( \text{Cu}^{++} \) and \( \text{Mn}^{++} \) to the reaction mixtures, keeping the concentration of substrate, oxidant and composition of acetic acid-water and temperature constant. The results of the effects of \( \text{Cu}^{++} \) and \( \text{Mn}^{++} \) ions on the rate of reaction of \( \text{N-} \) chlorophthalimide with cyclopentanol, cyclohexanol and cycloheptanol are summarized in following table:

**Dependence of rate on the concentration of metal ion catalyst \( \text{Cu}^{++} \) and \( \text{Mn}^{++} \)**

\[
10^3 [\text{NCP}] \text{ (mol dm}^{-3}\text{)} = 2.50 \text{ (1, 2, 3)} ;
\]
\[
10^2 [\text{Substrate}] \text{ (mol dm}^{-3}\text{)} = 2.50 \text{ (1, 2)} ; 2.00 \text{ (3)}
\]
\[
10^2 [\text{H}^{+}] \text{ (mol dm}^{-3}\text{)} = 1.0 \text{ (1, 2, 3)} ;
\]
\[
\text{HO-Ac-H}_2\text{O, % v/v} = 30 \text{ (1, 2, 3)} ;
\]
\[
\text{Temperature}^\circ \text{ K} = 308 \text{ (1, 2, 3)}
\]

**Table: 1**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>([\text{Cu}^{++}] \times 10^3) (mol dm(^{-3}))</th>
<th>Cyclopentanol (1)</th>
<th>Cyclohexanol (2)</th>
<th>Cycloheptanol (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.00</td>
<td>3.71</td>
<td>4.14</td>
<td>4.91</td>
</tr>
<tr>
<td>2.</td>
<td>0.50</td>
<td>3.96</td>
<td>4.32</td>
<td>5.43</td>
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<tr>
<td>3.</td>
<td>1.25</td>
<td>4.01</td>
<td>4.55</td>
<td>5.63</td>
</tr>
<tr>
<td>4.</td>
<td>2.00</td>
<td>4.51</td>
<td>4.79</td>
<td>5.77</td>
</tr>
<tr>
<td>5.</td>
<td>2.50</td>
<td>4.69</td>
<td>4.91</td>
<td>5.90</td>
</tr>
<tr>
<td>6.</td>
<td>4.00</td>
<td>4.98</td>
<td>5.47</td>
<td>6.22</td>
</tr>
<tr>
<td>7.</td>
<td>5.00</td>
<td>5.03</td>
<td>5.83</td>
<td>6.51</td>
</tr>
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</table>
Effect of CuSO₄ and MnSO₄ on the reaction rate of

![Graph showing the dependence of rate on catalyst with plots of k₁ vs [Cu²⁺]](image)

**Table: 2**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>[Mn⁺⁺] × 10⁴ (mol dm⁻³)</th>
<th>cyclopentanol (1)</th>
<th>cyclohexanol (2)</th>
<th>cycloheptanol (3)</th>
<th>10⁴ k₁ (s⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>4.14</td>
<td>4.91</td>
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<tr>
<td>2.</td>
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<tr>
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<tr>
<td>4.</td>
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<td>3.22</td>
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<tr>
<td>5.</td>
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<td>3.36</td>
<td>3.73</td>
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<tr>
<td>6.</td>
<td>5.00</td>
<td>3.07</td>
<td>3.29</td>
<td>3.67</td>
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</tbody>
</table>
Effect of CuSO₄ and MnSO₄ on the reaction rate of

**CONCLUSION**

The effect of these ions were studied by adding varying concentration of CuSO₄ and MnSO₄ to the reaction mixture, keeping the concentration of substrate, oxidant and composition of acetic acid and temperature constant. From above Table:1 and Table: 2 it is clear that the effect of increasing concentration of Cu⁺⁺ ions show acceleration in the reaction velocity while Mn⁺⁺ ions show retardation in the rate of oxidation reaction as shown in Fig.1 and Fig. 2. The effect of increasing concentration of Cu⁺⁺ ion shows an acceleration in the reaction velocity and Mn⁺⁺ ions was found to retard in the rate of reaction.

**REFERENCES**