

**Kinetics and Mechanistic Study on Oxidation of Mannitol and 1, 2 Propane-Diol
Using Osmium Tetroxide in Presence of Chloramine-T'**

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Abstract

Kinetics and mechanistic study on oxidation of Mannitol and 1, 2-propanediol using osmium tetroxide in presence of chloramines-T has been done. Osmium tetroxide has been proven as a better catalyst in alkaline medium for the oxidation of mannitol and 1,2propanediol. The main objective of this paper is to explore the catalytic potential of osmium tetroxide in alkaline or acidic medium with chloramines-T.

Key Words:-Oxidation studies, Mannitol, 1,2 propane-diol, osmium tetraoxide, chloramines-T

Introduction:

There has always been continuous demand for the application of new metal catalysts in the growth of various industries throughout the world. In spite of various reports on metal catalysts in the oxidation of various inorganic and organic compounds by different oxidants Although catalysts of Os^{1,2} (VIII), Rh^{3,4} and Ir⁵(III) have been reported with other oxidants but the osmium tetroxide catalysts in the oxidation of organic and inorganic compounds with chloramines-T has not been known yet. Hence, in the present investigation, the main objective is to explore the catalytic potential of osmium tetra oxide in alkaline or acidic medium with chloramines-T.

Chloramines-T is also a kind of oxidizing agent as it produces hypochlorous acid or hypochlorite in acidic or alkaline medium which is oxidizing in nature.

Osmium tetroxide has tetrahedral structure and fairly soluble in CCl₄ on account of its high covalent in nature and can be extracted from aqueous solution using CCl₄. The OsO₄ can be obtained either by burning OsO₄ or by the oxidation of reduced osmium solution with HNO₃ per oxydisulphate in sulphuric acid.

Objective of the work:-

Objective of the Work:-In presence of Osmium tetra oxide catalyst in chloramine-T oxidation is expected to open a new branch of research whose data may be of much interest to scientists engaged elsewhere. Therefore, emphasis on chloramines-T and also on bromamine-T (in few cases) Oxidation either in acidic or in alkaline media in the presence of osmium tetroxide have been made.

Experimental:-It has been divided into mainly three sections.

Section (A):-It represents the preparation of reagents.

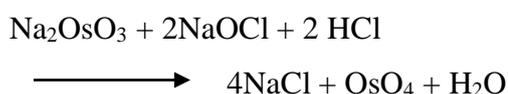
A (i) Preparation of Chloramine-T.

About 171 gr. (1mol.) of p-toluene sulphonic acid was dissolved in minimum amount of water and treated with excess of ammonia. The excess of unreacted ammonia was removed under vacuum. The oily mass obtained as dried product was treated with about 80 gram of sodium hypochlorite. The compound was recrystallised using isopropanol, filtered under suction and dried under the vacuum. Yield was nearly quantitative and was found to 200.0 gram of chloramines-T.

A. (II) Preparation of Osmium Tetroxide from Sodium Osmate (VI)

About 34.02 gr. (0.1 mol) of sodium osmate and 10 gram (0.125 mol) of sodium hypochlorite were dissolved in closed bottle containing 100 ml distilled water and warmed at 60⁰ C in water bath. The reaction mixture was cooled at room temperature and performed solvent extraction using 100 ml of CCl₄. The extractions process was repeated for thrice using 100ml of CCl₄ at each extraction. Finally the collected volume of all CCl₄ containing OsO₄ was subjected to slow evaporation at room temp and finally it was dried under vacuum to reduce. The yield of dried product as OsO₄ was found to be 25 gram.

The overall reaction is shown as follows:



Section (B):-It represents preparation of standard Reagents:

B.(i) Preparation of N/10 hypo-solution:

2.0 lit N/10 hypo-solution was prepared by dissolving a 24.8 gram of well dried sample of Na₂S₂O₃·5H₂O in 2 litre of distilled water.

B (ii) Preparation of N/10 Mohr's solution

2.0 litre N/10 mohr's solution was prepared by dissolving 78.4 gram of well-dried sample of ferrous ammonium sulphate. FeSO₄(NH₄)₂SO₄·6H₂O in 2.0 litre of double distilled air free water.

Experiments under this section have been performed both in alkaline as well as under acidic media separately. For each medium, the effect of the variation of temperature has been taken into account, i.e. at the room temperature and at elevated high temperature,

Section(c):It is main section of the research, experiments under this section have been performed both in alkaline as well as under acidic media separately for each medium the effect of the variation of temperature has been taken into account i.e. at the room temp and at elevated temp.

Result and discussion:-The result are obtained after investigation and is found that the rate of reaction is directly proportional to the first power of conc of OsO₄ and the plot (Fig-1) (OsO₄)_v/s(-dc/dt) gives a straight line showing first order dependence on OsO₄.

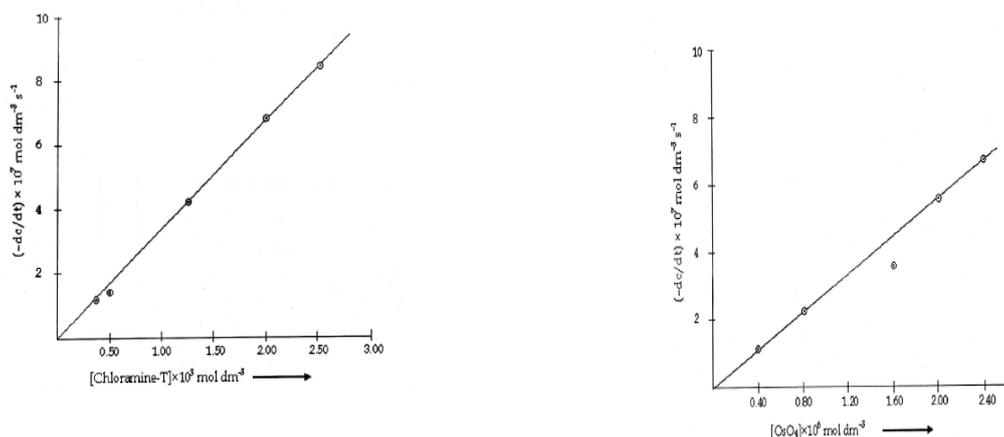


Fig- (i) Plot of $(-dc/dt)$ Versus [CAT] **Fig-(ii) Plot of $(-dc/dt)$ Versus [OsO4]**

Conclusion: In light of the recommendation of the present study for the future work, the extension of this study can be made in the area of industrial as well as polymer chemistry. The high toxicity and high expensive cost of the catalyst osmium

tetroxide can be controlled by an alternative use of structurally similar analogue of OsO_4 i.e. the use of sodium tungstate or sodium molybdate in such types of oxidation reactions in future work.

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