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Hydrolysis Product Analysis of Methyl Salicylate in Nitrogenous and Non-Nitrogenous Medium

Rajni Kumari[1,*]
[1]*Department of Chemistry, Gaya College, Gaya, Magadh University, Bodh Gaya, Bihar 824234*

Abstract:*Methyl salicylate (an ester) can be hydrolyzed to produce salicylic acid. The two different functional groups on the aromatic ring are utilized in this lab. First, the free carboxylic acid group will be produced when we hydrolyze the methyl salicylate. Methanol is the alcohol which is released by hydrolysis. The current study shows that for the Methyl Salicylate ester all parameter was calculated using Wynne-jones and Eyring equation. Here standard entropy and enthalpy found to decrease in various mixture. This may be due to greater desolation of initial state compared to the transition state. H° and S° were found to increase in water dioxan mixture whereas free energy was found to increase in both cases with increasing composition of organic co solvent.*

Background*: Methyl salicylate (oil of wintergreen or wintergreen oil) is an organic compound. It is the methyl ester of salicylic acid. It is a colorless, viscous liquid with a sweet, fruity odor reminiscent of root beer, but often associatively called "minty," as it is an ingredient in mint candies. It is produced by many species of plants, particularly wintergreens. It is also produced synthetically, used as a fragrance and as a flavoring agent.*

Materials and Methods*: A metal paddle stirrer driven by a small electric motor stirred the water of the thermostat regularly and vigorously throughout the experiment to keep the temperature uniform. The thermostat thus described was found capable of achieving temperature control. Baryta set, the main apparatus in use, was all glass class A° type of corning brand and consisted of a burette with automatic zero mounted on a reservoir of capacity inters.*

Results*: The typical runs for the several aspects of studies are carried out as: Effect of the initial concentration of the ester. Effect of the variation of initial concentration of the substrate in the reaction. Effect of the concentration of per chloric acid present in the reaction. Effect of the temperature on the rate of the reaction. Effect of dielectric constant of the medium. Effect of neutral salt on the reaction.*

Conclusion:*Methyl salicylate (an ester) can be hydrolyzed to produce salicylic acid. The two different functional groups on the aromatic ring are utilized in this lab. First, the free carboxylic acid group will be produced when we hydrolyze the methyl salicylate. Methanol is the alcohol which is released by hydrolysis. The current study shows that for the Methyl Salicylate ester all parameter was calculated using Wynne-jones and Eyring equation. Here standard entropy and enthalpy found to decrease in various mixture. This may be due to greater desolation of initial state compared to the transition state. H° and S° were found to increase in water dioxan mixture whereas free energy was found to increase in both cases with increasing composition of organic co solvent.*

Key Word*: Hydrolysis, Methyl Salicylate, Nitrogenous, Non-Nitrogenous Medium*

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I. Introduction

Methyl salicylate (oil of wintergreen or wintergreen oil) is an organic compound with the formula $C_6H_4(OH)(CO_2CH_3)$. It is the methyl ester of salicylic acid. It is a colorless, viscous liquid with a sweet, fruity odor reminiscent of root beer, but often associatively called "minty," as it is an ingredient in mint candies. It is produced by many species of plants, particularly wintergreens. It is also produced synthetically, used as a fragrance and as a flavoring agent.

Methyl salicylate can be produced by esterifying salicylic acid with methanol. Commercial methyl salicylate is now synthesized, but in the past, it was commonly distilled from the twigs of Betula lenta (sweet birch) and Gaultheria procumbens (eastern teaberry or wintergreen).Most instances of human toxicity due to methyl salicylate are a result of over-application of topical analgesics, especially involving children. Salicylate, the major metabolite of methyl salicylate, may be quantitated in blood, plasma or serum to confirm a diagnosis of poisoning in hospitalized patients or to assist in an autopsy.

Laidler and Landskroner[3] used Kirkwood's equation for the activity coefficient f, of a solute with an arbitrary distribution of charges embedded in a sphere of radius b and dielectric constant D, submerged in a medium of dielectric constant D. Laidler and Lanskroener evaluated free energy on the basis of construction of specific activated complex model of constantfree energy· It are bound to vary with the change in solvent composition. For knowing b. and G. of ion-dipolar reactions, without having any assumption for the model of the activated complex, Jha, Singh and Das[36] proposed a pair of equations, which were further improved by Singh et. al.[37] which give better result than that reported on previous occasions.

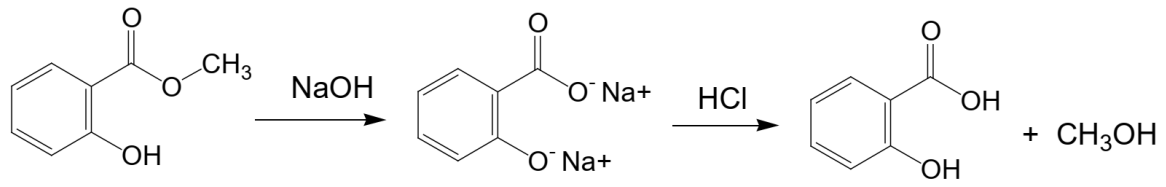
The following three assumptions have been made as to the amount of solvation to be expected in the presence of electric charges: (i) Solvation will increase with the magnitude of the change. (ii) Solvation will decrease with increasing dispersal of a given charge. (iii) The decrease of solvation due to dispersal of a charge will be less than due to sits destruction. Experimentally it is observed that solvent in some cases enhance a reaction considerably, while in other cases the effect is smaller. while studying the hydrolysis of amides i. e. ion-polar reactions, has evaluated a· for the hydrolysis of certain amides in water-dioxan and water- isopropanol solvents a. differs from b·, as the former is the sum of the radius of the activated complex and a certain constant.

II. Material and Methods

A metal paddle stirrer driven by a small electric motor stirred the water of the thermostat regularly and vigorously throughout the experiment to keep the temperature uniform. The thermostat thus described was found capable of achieving temperature control. Baryta set, the main apparatus in use, was all glass class A° type of corning brand and consisted of a burette with automatic zero mounted on a reservoir of capacity inters. It contained baryta solution of known strength for studying the kinetics of the reaction adopting titration process. Many other glass apparatuses, such as burettes, pipettes, conical flasks, measuring flasks, watch glass, beakers etc. were also in frequent use during the course of experimental investigation: they were all of corning registered grade.

III. Resultand Discussion

In case of hydrolysis of Methyl Salicylate in pyridine water media, the specific rate constant values were found to increase with increasing proportion of pyridine in the media.The Methyl Salicylate manufactured by W.J. Bush and Co. Ltd.; London was used. For its purification, 200 ml of theMethyl Salicylate was withdrawn from the sealed bottle containing it and taken in a 500 ml glass stoppered corning containing 40 grams of BDH grade sodium hydrogen carbonate. After being stoppered the flask was left for four hours with occasional shaking.



Methyl salicylate **Salicylic acid**

Then the ester was decanted into a dry clean flask having 20 g of BDH grade magnesium sulphate. The flask was stoppered, shaken for five minutes and allowed to stand for two hours. The ester was filtered and distilled using all Pyrex glass distillation apparatus having quick-fit interchangeable joints with an efficient fractionating column. All precautions were made to protect the receiver from atmospheric moisture? The constant boiling middle fraction at 137-140°C under the reduced pressure of 50 mm of mercury-column was created and stored for the study of the kinetic behavior.

To check and to calculate the value of precision, i e. reproducibility of kinetic runs and rate constants, the hydrolysis of Methyl Salicylate was repeated four times separately at 50% composition of dioxan (organic co-solvent). The concentration of the alkali, the amount of ester added and percentage of co-solvent were kept same for each repetition.

Thereby the rate increases as observed experimentally. But pyridine also a weak base, is unable to affect the dissociation after a certain limit. Therefore, the increase in rate becomes less appreciable after a certain time. The slight increase in rate thereafter might be due to the effect of dielectric constant alone which is also simultaneously operative and is of smaller magnitude. However, the understanding of these effects will be clearer later on with the study of the effect on activation parameter. Experimental value[6] of is compotation activation energy (E.,) were determined using Arrhenius equation. It was concluded from this observation that during the hydrolysis process either metal state is more solvated or the transition state is desolated to a greater extent than the initial state. But in Methyl Salicylate ester, all these parameters were found to increase in water ethylene glycol solvent system with increasing composition of organic co solvent.

The typical runs for the several aspects of studies are carried out as:1. Effect of the initial concentration of the ester.2.Effect of the variation of initial concentration of the substrate in the reaction.3.Effect of the concentration of per chloric acid present in the reaction.4.Effect of the temperature on the rate of the reaction.5.Effect of dielectric constant of the medium.7.Effect of neutral salt on the reaction.

IV. Conclusion

Methyl salicylate (an ester) can be hydrolyzed to produce salicylic acid. The two different functional groups on the aromatic ring are utilized in this lab. First, the free carboxylic acid group will be produced when we hydrolyze the methyl salicylate. Methanol is the alcohol which is released by hydrolysis.The current study shows that for the Methyl Salicylate ester all parameter was calculated using Wynne-jones and Eyring equation. Here standard entropy and enthalpy found to decrease in various mixture. This may be due to greater desolation of initial state compared to the transition state. H° and S° were found to increase in water dioxan mixture whereas free energy was found to increase in both cases with increasing composition of organic co solvent.

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