Benzene Nitration Procedure

Student’s Name

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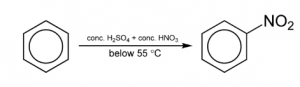
**Abstract**

The experiment was conducted to investigate products which are formed when benzene compounds are nitrated. In order to complete the study nitric and sulphuric acid, methylbenzene, flask, plate, a spoon was used. The correction procedure was used to complete the experiment and the result was obtained. The experiment established that nitrobenzene is the product formed when benzene react with nitric acid in the present of concentrated sulphuric acid. The temperature changes as the reaction continues to the highest of 3000C

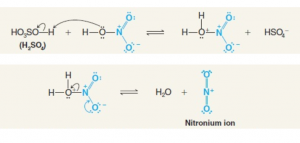
**Introduction**

Benzene is a colorless, volatile, highly flammable, liquid aromatic hydrocarbon. It has a gasoline like odor and therefore, it can catch fire easily. Benzene is exit inside the crude oil and mostly used as a byproduct oil refineries used for the production of various types of oils (Mane, Mane, Dongare, & Jadhav, 2014). According to Mane, Mane, Dongare and Jadhav (2014), nitration is used to add nitrogen into the benzene. Therefore, the chemical compound is the reaction of nitrogen and benzene. In the industry sector, Benzene is utilized as a solvent. It is also used to synthesis for several chemicals and as a chemical intermediate. Nitration of Benzene is regarded as electrophilic aromatic substitution reactions. It is pointed that benzene reacts with nitric using concentrated sulphuric acid as catalyst to form nitrobenzene. However, expose to the reactions or the substance can cause neurological affects, which can affect the born narrow hence causing anemia and excessive bleeding to the humane system. Moreover, it is six carbon aromatic annulene whereby each atom carbon provides one of its 2p electrons into the delocalized system. The purpose of the study is to investigate products which are formed when benzene compounds are nitrated. It is conducted to analyze and discover the aromatic compound which is formed when the compound of Benzene are nitrated. In order to successful complete this study, nitric and sulphuric acid, methylbenzene, flask, plate, a spoon. The correction procedure was used to complete the experiment and the result was obtained.

Benzene reacts with sulphuric acid or concentrated nitric acid to establish a nitrobenzene. As illustrated in the diagram below, when benzene reacts with nitric acid in the presence of sulphuric acid the nitrobenzene is formed. During the reaction of nitric acid and methylbenzene, the nitric acid accept the proton given by sulphuric acid and then detach is used to form nitronium ion. However, the whole process does not require heat since heat since, the sulphuric acid is used as catalyst in the entire process.



***Diagram 1: The formation of nitrobenzene***



***Diagram 2: formation of nitric acid and nitronium ion***

Some of the experiments which have been conducted established that when nitronium ion (NO2+), approaches or reach the benzene ring, nitropositive of the nitronium ion attracts, is attracted by the electron rich benzene ring and therefore, two of the ions from both inside and outside break down to establish or form a bond between benzene and nitronium ion.

**Material and methods**

The experiment was conducted in the lab and the following equipment and reagents were used for the success of the experiment. The H2SO4 (conc.) 1.0 mL HNO3 (conc.) 1.0 mL Toluene 1.0 mL Diethyl ether 8 mL 10% NaHCO3(aq) 10 mL HNO3, H2SO4 Labeled Na2SO4 weighing boats / scoop were used to complete the experiment. It is essential to note that sulphuric acid, nitric acid, flask, methylbenzene, spoon, and plate are very important component of the experiment. The reagent was added step by step to ensure that appropriate reaction is allowed. First, all the flasks, spoon, plates and other equipment were cleaned before any chemical or reagent is added. Heming, Litao, Xuehai, & Guangfu (2015) pointed that it is important to clean the equipments for experiment to remove any residues or remains which can interfere with the chemical reaction to give an incorrect result or errors.

First, methylbenzene was added to the flask (cleaned flask) and then the flask was moved to the stir plate. After that the sulphuric acid was added to methylbenzene. It was then stir and left for reaction to occur. The reaction was monitor through the TLC and every events or reactions monitored for the purpose obtain accurate process which occurs when sulphuric acid is added to the methylbenzene. It is important to note that the benzene, nitric acid and sulphuric acid reaction were conducted under temperature of lower than 500C. This is because an increased in temperature during the experiment can result to getting of more than one nitro group into the rig. For example, it can result to the form of NO2 to be substituted into the ring. The sulphuric acid is used as a catalyst to ensure that the reaction is faster and efficient to obtain a good result. The process of reaction of reagent was repeated twice and the detailed information is recorded to ensure that the result is accurate and the objective of the study is meant.

**Result**

The experiment indicates that the reaction of nitric acid, methylbenzene in the presence of sulphuric acid result to the formation of nitrobenzene and water. The nitric acid accepts a component of proton. In the case of reaction, the catalyst was found to amorphous and therefore, showing high dispersion. The increase of temperature was noted from 1000 to 3000, as the temperature increases the conversion also increase. When the temperature increases 2000 the formation of unidentified products started to be recognized in the traces. It is also established that the temperature of the reactant changes at every point when a reagent is added and therefore, it is important to point that the reaction as a point of conversation at the experiment shows that the point of conversation has a temperature of 2000C.

The result indicates that hydrogensulphate ion was formed during the reaction of electrophile nitronium ion, when the hydrogen attached was removed in the nitro group where the carbon is contain. The observation of the flask indicates that the color changes from colorless to yellowish color. The vapor was also produced from the flask at interval at every point of change of temperature. At above 3000 V the vapor reduced slowly and diminished.

https://www.chemguide.co.uk/mechanisms/elsub/nitrateq2.GIF

https://www.chemguide.co.uk/mechanisms/elsub/nitrateq1.GIF

**Discussion**

**Effect of WHSV on Nitration of Benzene**

From the experiment it is established that WHSV has influence on the nitration of benzene when the temperature reaches at 2000 C when a catalyst is used and diluted nitric acid and benzene molar at the ratio of 1.2 as illustrated in the diagram below. It was also noted that increase of WHSV reduces the conversion and the rate at which the product is being yield and therefore, the oxidation process increases to form a dinitro products. It established that at a lower WHSV of (0.087/h-1), the conversion was higher at around 86% and therefore, it means that the optimum resident of reactant is achieved for maximum conversion.

**The influence of Nitric acid to Benzene Molar Ratio**

The influence of benzene was established at 2000C and therefore, it is the point where the catalyst is used. The variation conversion of benzene with the stream of reaction used for the nitric acid to benzene at the ratio of 0.6 to 1.2 to establish the best reaction. The result shows that the reaction of benzene and the nitric acid can be achieved without the use of concentrated sulphuric acid. It was established that reaction of nitric acid, methylbenzene in the presence of sulphuric acid result to the formation of nitrobenzene and water. The nitric acid accepts a component of proton. In the case of reaction, the catalyst was found to amorphous and therefore, showing high dispersion. The increase of temperature was noted from 1000 to 3000, as the temperature increases the conversion also increase. When the temperature increases 2000 the formation of unidentified products started to be recognized in the traces. It is also established that the temperature of the reactant changes at every point when a reagent is added and therefore, it is important to point that the reaction as a point of conversation at the experiment shows that the point of conversation has a temperature of 2000C. The hydrogensulphate ion (HSO4–) which was formed during the formation of electrophile- nitronium ion, removes the hydrogen attached with the nitro group containing carbon. This hydrogen (H+) leaves the electron to the benzene ring. Thus the positive charge of the ring neutralized and delocalisation reestablished. By taking hydrogen ion, hydrogensulphate ion (HSO4–) becomes sulphuric acid as it was before (catalyst) (Benard, 2015).

The result indicates that hydrogensulphate ion was formed during the reaction of electrophile nitronium ion, when the hydrogen attached was removed in the nitro group where the carbon is contain. The observation of the flask indicates that the color changes from colorless to yellowish color. The vapor was also produced from the flask at interval at every point of change of temperature. At above 3000 V the vapor reduced slowly and diminished.

**Conclusion**

It is established that nitration of benzene (BZ) using nitric acid is promoted by catalysts for reaction to be effective. The change of temperature is identified through the process of reaction until the formation of nitrobenzene. It is also important to point that the nitrobenzene was formed from the reaction of nitric acid and benzene in the presence of concentrated sulphuric acid. During the experiment it was noted that the temperature changes from 1000 C to 3000 C. It is also pointed that the concentrated sulphuric acid provides a higher conversion at 2000 C. The major advantage realize from this reaction is the use of nitric acid. It is also obtained when methylbenzene reacts with nitric acid in the presence of concentrated sulphuric acid to establish a nitrobenzene and it is formed because nitric acid donate proton. The result of experiment also indicates that formation of nitrobenzene is established is facilitated by the use of sulphuric acid and when it reaches a higher temperature the conversion starts and the heat started to reduce. The reaction does not require heat because the concentrated sulphuric acid. It is also important to point that the experiment was conducted using the H2SO4 (conc.) 1.0 mL HNO3 (conc.) 1.0 mL Toluene 1.0 mL Diethyl ether 8 mL 10% NaHCO3(aq) 10 mL HNO3, H2SO4 Labeled Na2SO4 weighing boats / scoop were used to complete the experiment. These components made it possible to conducted experiment without a lot of difficult. It wqs therefore, established that several products are formed when benzene reacts with nitric acid

# Bibliography

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