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EXTRACTION OF CINNAMALDEHYDE FROM CINNAMOMUM ZEYLANICUM

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ABSTRACT

Cinnamomum Zeylanicum most commonly known as Cinnamon is a widely used aromatic condiment and a spice obtained from the bark of cinnamon tree. Cinnamaldehyde is an aromatic compound found in cinnamon bark. The primary aim of this study is to obtain cinnamaldehyde from Cinnamomum Zeylanicum. This was achieved by using steam distillation technique followed by a three-stage extraction process. The results obtained from the Schiff's test indicated that the product extracted was Cinnamaldehyde.

Keywords: Cinnamon, Extraction, Distillation, Cinnamaldehyde, Steam distillation.

I. INTRODUCTION

Cinnamon bark is one of the most important and widely used species worldwide in cooking as well as for traditional medicinal purposes. Nearly 250 different species of cinnamon have been identified till date. [1, 2] The molecular formula of Cinnamaldehyde is C_9H_8O and it has a molecular weight of 132.16 g/mol. It is an oily fluid of yellow color and can result in skin irritation when exposed at high concentration. It is a well known fungicide and is typically applied to the root systems of plants. Also, it is used as a corrosion inhibitor for various alloys in corrosive fluids.

The most important components which contribute to the fragrance of cinnamon are cinnamaldehyde and trans-cinnamaldehyde. [3] It has been indicated in a study conducted on Cinnamomum osophloeum that essential oil obtained from cinnamon contains a high content of cinnamaldehyde. [4,5]

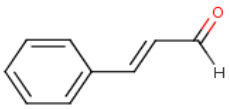

Figure:1 Structure of Cinnamaldehyde

II. MATERIALS AND METHODOLOGY

Extraction is a process in which one or more compounds are selectively separated from a liquid or solid mixture. Distillation is later used in this process, further step of separation.

a) Raw Materials

For this process, the raw materials used are mentioned below:

- 25.5gms of Cinnamon sticks.
- 300mL of Dichloromethane (DCM).
- Saturated Sodium Chloride solution (NaCl).
- Calcium Chloride ($CaCl_2$).

Cinnamon sticks were broken into smaller pieces and placed into a mortar, where they were crushed with the help of a pestle. In order to avoid foaming during distillation, the sticks were not completely crushed into powder form. Rather they were kept at a moderate size. DCM (solvent) used in the process was later recycled and recovered at the end.

b) Steam Distillation

About 25.5 g of freshly crushed Cinnamon sticks were added into a 250mL three necked distilling flask. 200mL of distilled water was added to it. Later, a 100mL of water was added to an addition funnel attached to one of the necks. The flask is heated with the help of a heater. A 100mL of graduated cylinder was used to catch the distillate. During the distillation process, a cloudy distillate travelling down the condenser column was noticed. 100mL of the cloudy distillate was collected. The cloudiness of the distillate is due to the presence of an insoluble suspension of Cinnamaldehyde. Hence, the level of cloudiness is a good indicator of the amount of Cinnamaldehyde present in the distillate. 100mL of the distillate collected was transferred into an Erlenmeyer flask. To collect further amount of distillate, 100mL of water was added to the distilling flask. The next batch of distillate obtained was clear indicating low amount of Cinnamaldehyde. Later, the distillates were combined and transferred to a separatory funnel.

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Figure 2: Distillate obtained

c) Extraction of Oil

60mL of DCM was used to wash the Erlenmeyer flask which was then added to the separatory funnel. The funnel was capped, shaken vigorously and the layers were allowed to separate. Due to its high density, DCM settled at the bottom of the separatory funnel. It was drained into a flask. The extract was sent to the next stage for further extraction. This process was repeated 3 times. 60mL of DCM was used in each stage. After the 3rd stage, the upper aqueous layer was clear, indicating that most of the Cinnamaldehyde had been removed.

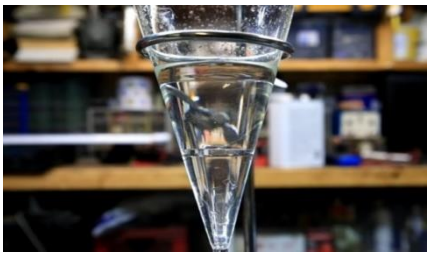

Figure 3: Third stage of extraction

d) Solvent Recovery

The DCM washings obtained in all the three stages of extraction were poured back into a separatory funnel and dried using Sodium Chloride solution. Later, they were drained into a flask containing Calcium Chloride. In the next step, the Calcium Chloride was vacuum filtered off and the solution obtained was drained directly into a round bottom flask (RB). A small amount of DCM was used to wash the remained amount of Calcium Chloride present in the flask. Distillation was carried out again to recover the DCM. When all of the DCM had been removed, the yellow oil which remained was transferred into a dram vial.

III. ANALYSIS

Analysis of the component extracted is an important step in any experimental procedure. In this process, the below mentioned tests were used to determine the nature of the extract.

a) Tollens test

Tollens test has been used in this process to determine the compound obtained. Two important things occur when an aldehyde is introduced to the Tollens reagent. Tollens reagent oxidizes the aldehyde and results in the formation of carboxylic acid. The silver ions present in the Tollens reagent are reduced into metallic silver. Usually, test is carried out in clean test tubes made of glass. This is because the reduction of the silver ions into metallic silver form a silver mirror on the test tube. Tollens test is commonly referred to as the Silver Mirror test due to the formation of this layer of metallic silver on the test tube. [6]

b) Schiff's test

Schiff's reagent is used as a qualitative test for aldehydes. It consists of an indicator dye, fuchsin hydrochloride, in a saturated solution of Sulphur dioxide. Sulphur dioxide decomposes the dye. When an aldehyde is added Schiff's Reagent, it reacts with the - SO_2 and thus restores the deep reddish-purple color of the dye.

c) Solubility test

Cinnamaldehyde is popularly known to be insoluble in water and soluble in oils and alcohols. Solubility test has been conducted for the extract and results are mentioned below.

IV. RESULTS AND DISCUSSION

Conformational test was carried out for the product obtained after extraction. As mentioned above, Tollens test, Schiff's test and Solubility test have been carried out and the results are discussed below.

When the extract was added to the tollens reagent, it resulted in the formation of a silver layer on the walls of the test tube. This led to the confirmation that the extract obtained is indeed an aldehyde.

When Schiff's reagent was added to the extract, the following observations were made:

Table 1: Result from Schiff's test

Cinnamaldehyde	The sample gave a deep magenta (purple) solution when added to Schiff's reagent.
Appearance of distillate	The distillate looked like oily water.

From this test, it has been identified that the extract is Cinnamaldehyde. 0.5g of nearly pure Cinnamaldehyde was obtained in this process.

The results of the solubility test are as follows:

Table 2: Results from Solubility test

Water	Insoluble
Chloroform	Soluble
Ethanol	Soluble

When the liquid in the condenser was collected, the oil seemed to be in the bottom layer of the flask. Cinnamaldehyde is thus more dense than water. Boiling point and melting range test were conducted for the extract in order to determine its boiling and melting point. The results obtained are as follows:

Table 3: Results from conformational tests

Boiling Point	248°C (477°F)
Melting point	-7.5°C (18°F)

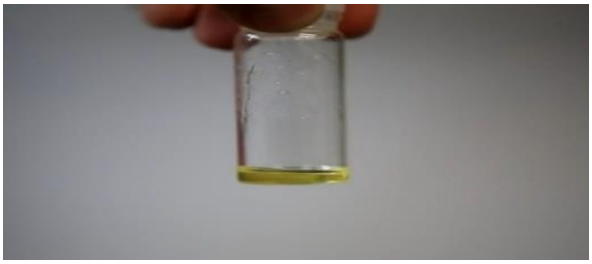

Figure 4: Extract

V. CONCLUSION

Cinnamaldehyde is one of the most important constituents of Cinnamon. The study conducted for the extraction of Cinnamaldehyde has resulted in obtained the product. However, the yield obtained was very low. Further research should be conducted to increase the amount of extract. Also, the compound can be further understood when subjected to high performance liquid chromatography. This test can help in understanding the purity of the extract and enables one to take steps accordingly.

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