Organic –Chem. 221 Lab

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Experiment No: (7)

Experiment title: The Essential Oils of Plants, Steam distillation.

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Abstract: (including objectives, chemical reactions, methods used and main results)

Main Objectives:

1. To use steam distillation to isolate oil from different spices.
2. To use extraction to separate the oil from water.
3. To measure the percentage yield of the oil.

Methods used: steam distillation, extraction.

Essential oils are oils extracted from natural substances, mostly plants and are very useful for humankind. The benefits of essential oils include their use in medicine and perfumes. They are also used for embalming and for their delicious taste in food depending on the plants scent and flavor. Examples on essential oils include: cloves, allspice, cinnamon, cumin, caraway and anise.
In this experiment, the oil extracted was from anise. This oil has great benefits due to the fact that it has thymol, terpineol and anethole, which are used for treating cough and flu. It also aids in improving digestion and reducing nausea. Anethole in particular has a minor component in it called p-allyl anisole which is an isomer of anethole.
The method of the separation of the essential oil from a spice is done using steam distillation. Steam distillation is a separation process used to purify or isolate temperature sensitive materials. It allows the compound to be distilled at a much milder temperature of under 100°C. Steam or water is added to the distillation apparatus, lowering the boiling points of the compounds. For this reason, this method is used for purifying liquids with very high boiling points.

Chemicals:

1. herbs (thyme)
2. Distilled water
3. Boiling chips
4. CH_2Cl_2
5. NaCl solution
6. $CaCl_2$

Glassware:

1. Round bottom flask
2. Condenser
3. Beaker
4. Erlenmeyer flask
5. Still head
6. Alcohol Thermometer
7. Receiving adapter
8. Separatory funnel
9. Wire gauze
10. Graduated cylinder
11. Bunsen burner

12. Ring
13. Stand
14. Clamp

Experimental Procedure:

The procedure of this experiment was taken from: Reference: The world of organic chemistry, a laboratory approach, David C. Eaton, page 48-53, experiment #7.

Data:

Table 1: data collected in experiment

Name and structure	weight	molecular weight	Density
herbs (thyme)	15 g	922.886 g/mol	0.980 g/mL
Dichloromethane CH2Cl2	------	84.93 g/mol	1.33 g/cm³
Saturated salt NaCl	------	58.44 g/mol	2.16 g/cm³
Calcium Chloride CaCl2	-------	110.98 g/mol	2.15 g/cm³

Table 2: Experimental Results

Product	Grams Recovered	Experimental % Yield
Thyme oil	1.14 g	5.7 %

Calculation and results:

Mass of essential oil = Mass of filled beaker- mass of empty beaker
= 45.47- 44.33
=1.14 g.

Percentage Yield= (Mass of essential oil/ Mass of original spice) *100%
= (1.14/ 20.0) * 100%
= 5.7% essential oil is found in eugenol.

Discussion & Comments:

In this experiment, the method used was steam distillation. The advantage of distillation is that the volatile components can be distilled at temperatures lower than the boiling points of their individual constituents and are easily separated from the condensed water. The method produces organic solvent-free products and there is no need for further separation steps. Steam distillation also has a large capacity for processing at the industrial scale and the equipment is inexpensive.

The main aim of this experiment was to measure the percentage yield of a specific oil. The oil chosen in this experiment was thyme and the percentage yield turned out to be 5.7 % which is a very low yield. the process to establish this yield is very long. This yield might seem too small to even be considered but it is very normal to obtain a small amount of oil after all the separation done to purify and obtain "essential" oil. Also, there is no escape from experimental errors such as losing some of the product which decreases the yield.

Questions:

Q1.

In steam distillation, the lower boiling point reduces decomposition of temperature-sensitive compounds.

Q9.

Because some of the essential oils are good and valid for consumer use and others are not. So, we extract the essential oils that can be used by the consumers and we do not extract the others.

Q10.

Steam distillation takes advantage of the volatility of the compounds in the essential oil to evaporate when heated with steam and the hydrophobicity of the compound to separate into an oil phase during condensation.