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EXTRACTION OF D- LIMONENE FROM ORANGE PEELS

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ABSTRACT

The orange peel which is considered as a waste can be used for the extraction of limonene (D-Limonene) which has many applications ranging from food flavouring agent to cosmetics. Limonene can be extracted by various conventional methods like steam distillation cold press, solvent extraction, novel methods like super critical CO2 extraction, it means varied typical ways like steam distillation cold press, solvent extraction, novel ways like super essential greenhouse emission extraction. The conventional method though simple are robust and the yield percentage is less whereas the novel methods are not cost effective as well as easy the yield share is a smaller amount whereas the novel ways aren't price effective.This experiment demonstrates the extraction of plant oils. The peel of oranges is boiled in water and the oil produced {limonene} distilled in steam at a temperature just below 100℃, well below its normal boiling point. This experiment demonstrates the extraction of plant oils . The depart oranges is cooked in water and therefore the oil created distilled in steam at a temperature slightly below a hundred℃, well below its traditional boiling purpose. The incompatible oil will then be separated. Direct extraction by heating would lead to decomposition whereas steam distillation doesn't destroy the attractive force.Limonene is an unsaturated hydrocarbon which can be tested for using bromine water or potassium magnate which may be tested for victimization element water or potassium business leader.

Keywords*: Orange peels, D-limonene, steam distillation.*

I. INTRODUCTION

Low molecular weight water immiscible compound can be separated by natural gas product by steam distillation. In this case steam distillation is use to isolate essential oil limonene from orange peels. Limonene is concentrated in the peel of oranges. The orange peels have two distinct layers, the skin and the pith .Limonene is not distributed evenly between these two layers. Experimentation has shown that only minimum quantities of limonene can be extracted from white pith. The outer skin accounts for the 2/3 of the mass of the peel. The best yield of limonene can be obtained from outer skin.[2]

D-Limonene is obtained as a by-product of the citrus juice industry. It is the major component of the oil extracted from the rinds of citrus fruits. There are two main grades of d-Limonene which are called food grade and technical grade. Once citrus fruits square measure juiced, the oil is extracted out of the rind. The juice is separated from the oil and the oil is distilled to recover certain flavour and fragrance compounds. This is called food grade d-limonene which is 96% to 97% pure and has a mild orange aroma. After the juicing process, the peels are taken to a steam extractor. More oil is extracted from the peel. When the steam is condensed, a layer of oil floats on the surface of the condensed water. This is called technical grade d-Limonene which is 95% pure and has a strong orange aroma. Both products are called orange turpenes.

Pure D-Limonene is lighter than water, and is usually colourless industrial products. D-Limonene can be used as a straight solvent or as a water dilutable product.

In this process steam distillation was used to extract oil from orange peels research has confirm- centuries of practical use of limonene and we know that fragrant pharmacy contains compound with an extremely broad range of bio chemical effect with extremely broad range of biochemical effect. The recovery of essential oil from orange peels as a starting material is very important. Analysis of essential oil was done using gas chromatography-mass

spectroscopy apparatus, which gives qualitative volume of oil obtained, was changing with respect to the time and quantity of orange peels.[1]

A. Motivation And Objectives

Idea behind this is increasing demand of citrus fruits juice by people increases the production of juice in the citrus fruit juice industries, at the same time, waste peels from industries are used to extract the D-limonene for the several applications.

- Fruit peels like orange and lemon are discarded after consumption.
- Combustable, thus can be used as a potential renewable biofuel.
- Important medicinal properties: sedative, anti-stress, anti-carcinogenic, relieves heartburn and gastrointestinal reflux.
- Useful in chemical synthesis: a precursor to carvone.
- Solvent for cleaning product
- Used in cosmetic products, food flavourings and as a fragrance in the perfume industry.

B. Methods Of Extraction

- Cold pressing.
- Solvent extraction.
- Steam distillation.

By using Steam Distillation Extraction we conduct this process

Steam distillation could be a special kind of distillation or a separation method for temperature sensitive materials like oils, resins, hydrocarbons, etc. that square measure insoluble in water and will decompose at their boiling purpose.The elemental nature of steam distillation is that it permits a compound or mixture of compounds to be distilled at a temperature well below that of the boiling point(s) of the individual constitute(s). Essential fifteen oils contain substance with boiling stress to 200℃ or higher temperature. within the presence of steam or boiling water, however, these substance square measure gasified at a temperature 10℃ terribly near gas pressure.

Variety of things determined the ultimate quality of a steam distilled volatile oil. excluding the material, most vital square measure time, temperature and pressure, and quality of the distillation instrumentality. Essential oils are very complex products. Each is made up of many, sometimes hundreds, of distinct molecules which come together to from the oil's aroma and therapeutic properties. Some of these molecules are fairly delicate structure which can be altered or destroyed by adverse environmental conditions. So, much like a fine is more flavourful when made with patience, most oils benefit from a long, slow 'cooking' process.

It is possible that longer distillation times may give more complete oil. It is also possible however, that longer distillation time may lead to the accumulation of more art facts than normal. This may have a curious effect of appearing to improved the odor, as sometimes as sometimes when materials that have a large number of components are sniffed, the perception is often of slightly increased sophistication, added fullness and character, and possibly, and extra pleasantness.[3]

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C. Chemical structure of limonene

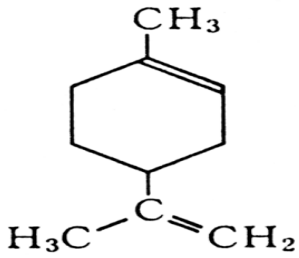

Fig- 1 Molecular Structure Of Limonene

D. Properties Of Limonene

- Molecular formula : C10H16
- IUPAC NAME: 4-ISOPROPENE-1-METHYLE-CYCLOHEXANE
- Molar mass : 136.24 g/mole
- Density : 841kg/m^3
- Melting point : 74.35°C
- Boiling point : 176°C
- Specific gravity : 0.838 at 68^0F
- Physical State : Colourless or pale yellow
- **Limonene** is an alkene, meaning its functional group is C=C, its suffix is-ene and its formulaic CnH2The Molecular formula is $\mathbf{C_{10}H_{16}}$.
- Its full name is 1-methyl-4-prop-1-en-2-yl-cyclo hexane.
- **Limonene** melts at -95.2 °C and it boils at 176 °C, therefore **Limonene** is liquid at room temperature.
- It is lighter than water and insoluble in water, unless a surfactant is added.
- D-**limonene** is considered a combustible liquid. **Limonene** is a cyclic terrene[5].

E. Applications Of D-Limonene

1. Cleaner for concrete

D-limonene will usually clean graffiti (including effectively replacing xylene in graffiti removers) off concrete because of its ability to remove paint. Strong enamels and epoxy paints will not usually be removed.

2. **Release Agent**

D-limonene can be used at various levels for a release agent that is sprayed on the beds of asphalt trucks before picking up their loads to facilitate easy unloading. Since d-limonene will not readily freeze (-142º F freezing point), the product lends itself to underground storage through cold winters.

3. Straight Solvent Replacement

D-limonene is a great solvent to directly replace the toxic solvent components in existing solvent blends. One example is the 1:1 substitution of d-limonene in the place of xylene or 111 tri-chlor in blends with other inexpensive solvents to make up the balance (mineral spirits, isopropyl alcohol).

4. Digestive problems

D-limonene has amazing curative properties for healing various stomach problems, for example; indigestion and bloating. Add a mixture of equal parts essential oils for example lavender or rose wood to orange oil and rub carefully on the skin over the stomach area.

5. Hand cleaner

D-limonene is very effective removing almost any soil including: ink, paint, grease and tar .solvent based hand cleaners usually contain approx. 30% solvent. At 10%, D-limonene will out-perform most other solvent hand cleaners.

6. Penetrating oil

D-limonene can be used as the spray on product to loosen bolts and nuts, much like WD-40™. D-limonene has the ability to wick into tight joints and dissolve hardened greases and oils to assist in the removal of bound nuts and bolts.

7. Adhesive removal

D-limonene is very good solvent for removal of adhesives from various substrates. Most contact adhesives will dissolve very quickly; however, D-limonene has almost no effect on epoxies which have already cured [4]

II. MATERIAL AND METHOD

A. Apparatus

- Two necked round bottom flask
- Burette stand
- Condenser
- Measuring cylinder of 2.5ml
- Heater

B. Raw Material

- Orange peels =15 grams
- Distilled water =50 ml

C. Procedure

1. Grate the outer orange colored rindof 2 oranges andboost100 ml distilled. Water within the 250 cc spherical round-bottom flask.
2. Found out the distillation equipment as shown within the equipment section.
3. Heat the flak in order that distillation issue at a gentle rate more or less onedrop per second of liquid.
4. Collect more or less fifty cc of liquid within the activity cylinder. The oilLayer are on the surface.
5. Employing a dropping measuring system fastidiously take away the oil layer into a tube.

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Fig-2: Layer of D-limonene obtained

III. METHOD OF ANALYSIS

The qualitative and quantities analysis was done to identify the constituents in the oil and the percentage of component present in the oil respectively.

A. IODINE TEST

This test is performed to check the presence of unsaturated bonds in a molecule. Few drops of the orange oil were taken in a test tube. A few crystal of iodine were added and shaken well.[7]

B. pH TEST

The pH of any liquid sample is generally measured using pH meter. A few ml of the orange oil was taken for pH analysis. **[7]**

Fig-3: Iodine test

IV. RESULT AND DISCUSSION

A. Extraction of D-limonene

The orange peels were cut into small size and were pre heated below 100 degree Celsius at constant temperature at 30, 60,90 and 120 minutes respectively for 4 readings. It has been observed that yield of the D-limonene increases with increasing time. Steam distillation is the promising method for the extraction of D-limonene. The increase in orange oil d-limonene yield (%) by steam distillation is more due to reasons that the orange peels were pre heated which softened the cell walls of the orange peels which are made up of cellulose, hemicelluloses and pectin and the orange peels were pre heated that softened the cell walls of the orange peels that square measure created of polysaccharide, hemicelluloses and cellulose. once the pre heated peels were additional subjected

to traditional steam distillation procedure, it additional softened and open the cell walls of the orange peels to liberate all the parts gift in it within the variety of orange oil.

1. Iodine test

Iodine take a look at was the characterization take a look at for the presence of any unsaturated compound in an exceedingly take a look at sample. On addition of iodine, the colourless oranges oil sample extracted by steam distillation become brown colour. The presence of d-limonene and alternative aromatic compounds within the sample was confirmed. The brown colour is thanks to the reaction of iodine with d-limonene and alternative unsaturated compounds like essential oil, Miocene, α-pinene,β-pinene.[7]

2. pH Test

The oil samples after distillation of the pre-heated peels were collected and subjected for pH analysis using a pH meter. The pH value of sample found to be 4.98, which is very much acidic in nature.[7]

Formulae for finding yield%after extraction process:

- %Yield=(final mass of orange oil/ initial mass of orange peel)*100 (1)
- % yield = (0.4/50)*100=0.8(2)
- % yield = (0.8/50)*100=1.6 (3)
- % yield = (1.1/50)*100=2.2(4)
- % yield = (1.5/50)*100=3(5)

B. Observation table

Table no 1: Volume of oil collected (ml) per 50 gram of orange peels

Sr. no.	Weight of orange peel (gm)	Volume of oil collected (ml)	Time (min)
1	50	0.4	30
2	50	0.8	60
3	50	1.1	90
4	50	1.5	120

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C. Graph

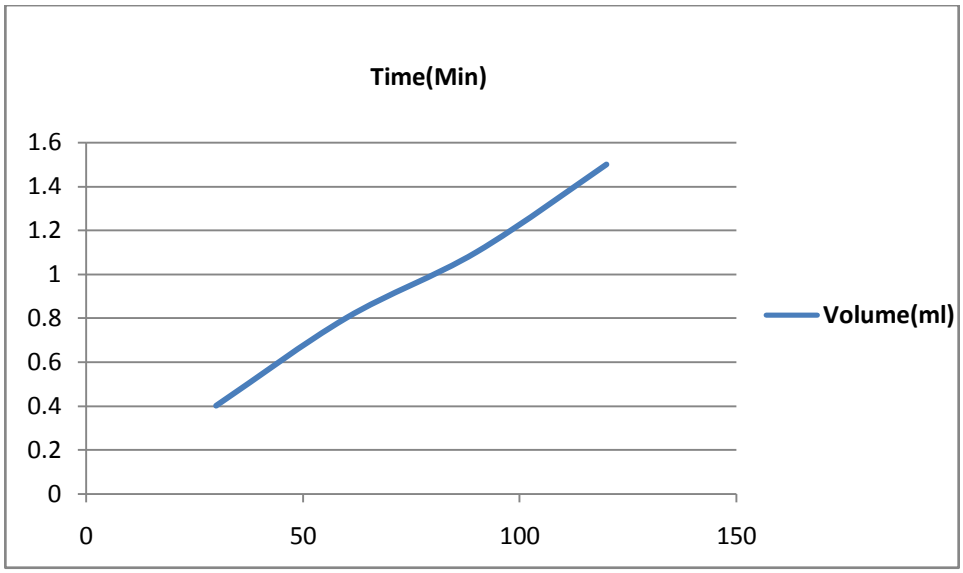

Fig-4 Graph- Time Vs Volume

V. CONCLUSION

- Finally we conclude the following deductions from the above experimental and analysis part.
- Steam distillation method was found to be one of the promising technique for extraction of orange peel oil D-limonene.
- Volume of orange peel oil D-limonene increase with increase in time by keeping temperature as constant.
- As the time increases percentage recovery of orange oil also increases.

VI. ACKNOWLEDGEMENT

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