IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Red Onion Essential Oil Extraction For A Variety Of Medicinal, Chemical And Industrial Uses

PARTHSINH ARVINDSINH CHAVDA
MASTER OF SCIENCE IN CHEMISTRY
PARUL UNIVERSITY

Chapter 1: ABSTRACT

People who live in today's highly stressed society are becoming more and more affected by various diseases, many of which are less responsive to standard medical care. Due to their well-known therapeutic properties, onions are often used in food preparation.

The ideal vegetable for cooking, garnishing, and treating illnesses. The one type of onion (Allium cepa) used in this study were used to extract the essential oil, which was then characterised and preserved for commercial use. The procedure of steam distillation and the chloroform was used to extract the oil. For the investigation, one onion species was gathered and employed.

The following analysis were carried out on the essential oil produced.

(i) pH value
(ii) Acid value
(iii)Iodin value
(iv)Refractive Index
(v) Peroxide Value

The outcomes were matched with edible oil sold in stores. Commercial oil was discovered to be synthetic and to have a completely different chemical make-up from onion's natural essential oil. Hence, synthetic oil cannot be replaced for natural essential oils or used therapeutically. According to studies, red onions contain a chemical called quercetin, a strong flavonoid, at a concentration of 22.01% in their essential oil (antioxidant). Monoterpenes (3.1%), sesquiterpenes (17.21%), and quercetin (22.01%) are additional compounds that are recognized as being extremely necessary in the human body.

Chapter 2: INTRODUCTION

Food odours are typically extracted for a variety of reasons, including improved microbiological stability, the ability to add less volume for storage and handling following a thermal procedure, which improves the food's flavour qualities, and the presentation of extracted odours.

having the benefit of being ready all year long. Because of the benefits listed above and the development of new packing techniques, such as micron capsulation, which significantly extends the shelf life of essential oils, the use of aromas and essential oils has increased recently, particularly in relation to seasoning products like onions, garlic, leeks, cloves, etc.

The main technique for extracting essential oils and flavour concentrations has existed for years. Steam distillation. By using this method, Semler created the first essential onion oil in 1892 and even named a few of the fragrance components it contained. The extraction technique by injecting steam into the food, steam distillation has the benefit of primarily removing volatile chemicals from the food. However, many fragrance components with relatively high volatilities are not separated by this process.

Manufacturers of food aromas have experimented with alternative extraction techniques such direct solvent extraction and distillation by gas entrainment. On an industrial scale, this last technique is used to goods like hops, coffee, and vegetable oils, but it doesn't appear to have been applied to goods used for seasoning, like onions.

Choosing the appropriate solvent is the most important part of the direct solvent extraction process for obtaining food aromas. The first condition is that the solvent used in this kind of procedure match to food stuff standards. Despite the fact that these requirements may differ from one nation to another, some of them include high levels of purity (food grade), inertness (the solvent must not react with any food

chemicals), as well as the need for it to be non-toxic and simple to separate from food. Together with these considerations, the solvent must be selected such that the food's scent components are only extracted when necessary. The solvent's accessibility and cost must also be taken into account.

Although though the extraction of food scent components has been practiced for a long time, some essential oils, such as onion oil, cannot be tested using standardized procedures. A wide range of techniques are suggested in the literature for evaluating onion oil, from the highly complex combination mass spectroscopy-gas liquid chromatography to the estimation of the total Sulphur content of the oil or fragrance concentrate. As most research on the extraction of essential oils is done by private sector and little information is made available to the public, it is likely the reason why there isn't a widely accepted method to evaluate these sorts of oils. The extremely complex makeup of these essential oils only serves to further compound this.

The goal of this research is to create a technique for directly using a solvent to extract onion oil. In keeping with the requirements for solvents used, the extraction's solvents were selected from a variety of those that were allowed for use in medical and industries. A fermentation approach was used to increase the yield of onion oil and simplify the extraction procedures. Three methods were used to assess the final product: organoleptic evaluation of the onion oil; total Sulphur content determination; and comparative determination of dipropyl disulphide, the primary flavoring agent in onions, by infrared spectroscopy. Moreover, the refractive index, specific gravity, and melting point of the oil were established.

One of the most major agricultural products in the world is the onion (Allium cepa L.). The species is a member of the Liliaceae family and is one of the oldest crops in existence (TRAM NGOC et al., 2005).

Here top 5 List of Countries by Onion Production:

	Country	**Production (Tone)**	**Production per Person (Kg)**
	China	23.907.509	17,152
	India	19.415.425	14,527
	Egypt	3.115.482	31,955
	United States of America	3.025.700	9,231
	Iran	2.345.768	28,692

Although there is now a limited commercial supply, onion seeds are also used. Perhaps if customers were more knowledgeable about the nutritional and practical benefits of onion seeds, there would boost the amount of commerce for this item (DINI et al., 2005, DINI et al., 2008a). Red onion seeds were examined by DINI et al. (2008b), who discovered that they contained 10.5% moisture, 20.4% oil, and 24.8% crude protein. Onion seeds only have a very low concentration of these ingredients; however, onion bulbs are a

source of cysteine derivatives, making them a useful meal. Because they enhance glycaemic control, reduce food intake, and trigger adipose tissue cell death, their presence should be significant for the treatment of obesity (LU et al., 2011; ROLDAN et al., 2008). According to PARRY et al. (2006), onion seed oil has a refractive index of 1.4752.

They discovered that onion seeds contain 6.4–7.1% palmitic acid (C16:0), 24.8–26% oleic acid (C18:1), and 65.2–64% linoleic acid (C18:2) in terms of the fatty acid composition of seed oils.

Due to the importance of plant seeds for nutrition, industry, and medicine, there has been an increase in interest in finding new sources of edible oils in recent years (NEHDI, 2011a). Customers have a strong demand for seed oils since they are full of bioactive components that protect against disease and help to improve human health. Yet, due to the varying compositions of oils obtained from different sources, no oil is sufficient for all uses. In view of the rising need for nutrition and (CERCHIARA et al., 2010; SILVA et al., 2009; DJENONTIN et al., 2009; NEHDI, 2011b; KESARI et al., 2010; HOED et al., 2011) Functional qualities of oils and scientific awareness, quality assessment of currently wasted oils demand special attention. There has been many research on different onion cultivars, but relatively few of them have specifically focused on the chemical and functional characteristics of onion seeds. With the identification of fatty acid composition and volatile chemicals, the primary goal of this study is to highlight the range of physic-chemical properties of onion seeds. Turkey-adapted variety of onions were employed in this investigation. Sadly, there is little documentation on these onion seed variants that have been modified for use in Turkey.

People who live in today's highly stressful environment are becoming more and more exposed to new ailments that are less acceptable to conventional medical therapy. Many people who have been dissatisfied with conventional treatment have moved to complementary therapies, which rely more on historical and observational evidence than on scientific proof. Most of the traditional usage of some plants for therapeutic purposes have been supported by modern study.

Essential oils and other medicines produced from plants still have a lot of untapped therapeutic potential. Most of the pharmaceuticals we use today are based on physiologically active chemicals that have been found in numerous medicinal plants. However, there is still a great deal to learn about their precise pharmacology.

Regarding essential oils with such a composition, this is particularly pertinent. However, as stated by researchers in the Encyclopedia of Essential Oils, "just a small fraction of the global floral has been studied for phrenologically active chemicals, but there is a genuine concern that many vital plant sources may be lost given the ever-increasing threat of plant extinction."

Thus, it is necessary to research and protect the environment since it may yield essential information for the treatment of numerous modern-day diseases, including cancer, infections, and others.

The onion, or Allium cepa, is a particular plant with a wide range of therapeutic use. They are recognized as a top source of fiber, chromium, biotin, and vitamins B6 and C.

Moreover, onions are well-known for having high levels of folic acid, vitamins K and B1, and both. The existence of many chemical compounds and flavonoids, which are released when an onion is crushed or simply chopped, accounts for the various health advantages of onion extract or even whole onions. It is present practically everywhere in the world, but is absent from Northern Nigeria.

Red, brown, and white are the most common colors for onions. Throughout much of the world, red onions are utilized in food methods like grilling and charbroiling. White onions, on the other hand, are a common element in most Mexican cooking and have the tendency to give a meal a sweet flavor when they are cooked.

Similar to how brown onions are famous for enhancing basically any type of dish due to their mild flavor.

One of the most popularly grown species in the Allium genus is the onion, also known as the garden onion, bulb onion, common onion, shallot, green onion, and the spring onion.

Onions are essentially a collection of modified onion plant leaves that are centered on a thin stem base. Other from the onion itself, another useful component of the plant is the stems, which have a tendency to be delicious and advantageous to health, particularly if eaten when they are fresh and young.

Onions are well-known for being a great source of fiber, chromium, biotin, vitamins B6 and C, as well as other nutrients and therapeutic benefits. Moreover, onions are well-known for having high levels of folic acid, vitamins K and B1, and both. Due to the presence of many chemical compounds and flavonoids that are generated when an onion is sliced or crushed, onion juice and even entire onions provide a variety of health benefits.

Many clinical and experimental studies have been carried out by researchers from all over the world with the aim of finding new chemicals that have low toxicity and high efficacy and could improve human health.

The therapeutic benefits of the plant have been the subject of many investigations. Nonetheless, the species varies greatly in many nations and states, and it is occasionally considered to be multiples of ten unique species. Consequently, due to several elements such geo-climatic location, soil type, plant life stage, pollution, and time and day of harvesting done, onion growing can differ substantially from onion growing in China and other nations. Despite the fact that onions are widely used in Nigerian traditional medicine and food, little studies have been conducted there.

Studies comparing the onion oil to essential oils have been conducted all over the world. Onions, like their cousin garlic, have several qualities that prove effective in treating high blood pressure and fungal infections, even though not many people think of them right away.

When its prepared products are generated, many medicinal plants, like onions, can readily become contaminated by heavy metals from the environment throughout the production and growth processes.

The sources of heavy metals in the air, soil, and water include precipitation, atmospheric dust, fertilizers, and plant protection chemicals. As onions have various medicinal applications, quality monitoring is essential to safeguard customers from infection.

Onion is one of Indonesia's key strategic goods (Allium cepa). It can survive in a hot summer and is frequently planted in Southeast Asia.
One kind of vegetable that is utilized in the food industry as a flavoring and ingredient is the onion. Onions are useful for more than just seasoning; they are also quite healthy. It contains roughly 15% protein per 100 g, 0.3% fat, 9.2% carbohydrates, 50 IU of beta-carotene, 30 mg of thiamine, 20 mg of niacin, 0.04 mg of riboflavin, 9 mg of carbonic acid, 334 mg of potassium, 0.8 mg of iron, and 40 mg of phosphorus. Onions possess a variety of chemical and biological qualities, including antimutagenic, antibacterial, antioxidant, antidiabetic, and anticancer effects.

After that, the onion can be extracted to create essential and onion oils that are beneficial to human existence. The extract's onion oil would have a high perceived value and might be used in industry extraction procedures. Current research has been done to determine how to extract onion's essential oil. It contains organosulfur compounds, and those are the major elements.

By using traditional techniques like maceration, steam distillation, Soxhlet extraction, etc., the earlier study has been verified. Many different extraction techniques have been created to Many techniques were used to extract the phenolic chemicals from the onions, including pressurized liquid extraction, the ultrasound method, supercritical fluid extraction, and subcritical water extraction. Unfortunately, the extraction yield that was obtained is very poor. The use of organic solvents in some extractions and the presence of those solvents can have an impact on the food industry, the pharmaceutical business, and other industries. Microwave radiation-based extraction method is expected to result in even heating throughout the operation. The quantity and quality of the products obtained from the extraction process must therefore be improved. In materials with water, microwave heating is particularly efficient. It may effectively absorb the energy from these microwaves through a process known as dielectric heating (dielectric constant).

Red onion seeds were examined by DINI et al. (2008b), who discovered that they contained 10.5% moisture, 20.4% oil, and 24.8% crude protein. Onion seeds only have a very low concentration of these ingredients; however, onion bulbs are a source of cysteine derivatives, making them a useful meal. Because they enhance glycemic control, reduce food intake, and trigger adipose tissue cell death, their presence should be significant for the treatment of obesity (LU et al., 2011; ROLDAN et al., 2008). According to PARRY et al. (2006), onion seed oil has a refractive index of 1.4752. They discovered that onion seeds contain 6.4–7.1% palmitic acid (C16:0), 24.8–26% oleic acid (C18:1), and 65.2–64% linoleic

acid (C18:2) in terms of the fatty acid composition of seed oils. Due to their nutritional, industrial, and therapeutic benefits, there is an increasing interest in discovering new sources of edible oils, such as plant seeds. importance (NEHDI, 2011a) (NEHDI, 2011a). Customers have a strong demand for seed oils since they are full of bioactive components that protect against disease and help to improve human health. Yet, due to the varying compositions of oils acquired from diverse sources, no oil is adequate for all uses.

Quality evaluation of currently unused oils attracts special attention due to the growing demand for information on the nutritional and functional properties of oils and scientific awareness (CERCHIARA et al., 2010; SILVA et al., 2009; DJENONTIN et al., 2009; NEHDI, 2011b; KESARI et al., 2010; HOED et al., 2011).

There has been many research on different onion cultivars, but relatively few of them have specifically focused on the chemical and functional characteristics of onion seeds. This study's primary goal is to highlight the various physiochemical characteristics of onion seeds while also identifying their fatty acid content and volatile chemicals. Turkey-adapted cultivars of onions were employed in this investigation. Sadly, there is little documentation on these onion seed variants that have been modified for use in Turkey.

The oregano sulphide components of steam-distilled onion oil are well-liked in the food and health industries because they provide flavorful flavors, act as antioxidants, prevent food from browning too soon, and slow the growth of pathogenic and spoilage microorganisms.

Steam distillation is one commercial way to extract onion oil from yellow onions; the oil is then marketed to restaurants as a commodity as a foodstuff flavoring element, or as a therapeutic essential oil for reviving hair follicles and a homoeopathic treatment for alopecia areata.

Solid phase microextraction, headspace, or liquid-liquid extraction have all been used to separate oregano sulphide components from steam distilled onion oil.

Recently, the composition of the volatile organic compounds in shallot and onion was compared using solid phase microextraction, which uses specialized fibers coated with extraction polymer or adsorptive particles embedded in a polymer to capture volatile molecules for analysis by GC-MS.

The right fiber must be chosen for the best component analysis since the solid phase microextraction fibers are specifically designed for the analysis of volatile organic compounds. Sample Stringent method development is required to achieve adequate volatile organic compound absorbance onto the solid phase 14 microextraction platform to enable GC-MS injection concentrations suitable for analyte identification and characterization. The initial cost of using this approach includes the solid phase microextraction fiber sample holder, solid phase microextraction fibers, and headspace injection apparatus. The headspace assembly attachment for the GC is also necessary for headspace analysis of volatile organic substances. Because that gas phase input into the GC is inherently diluted, the concentration of volatile organic compounds can be difficult to achieve. Last but not least, heating is needed for the headspace volatilization of the sample, just like with onion oil, which can cause the volatile organic components to degrade before being identified.

The liquid-liquid extraction method is possibly the simplest and most dependable method for characterizing volatile chemical compounds from onion oil. The method of steam distillation with the help of chloroform was used in the current investigation to test a number of organic solvents for the qualitative and quantitative extraction of oregano sulphides from onion oil prepared by steam distillation of yellow onions (Allium cepa L.).

The liquid-liquid extraction of oregano sulphides from onion oil was tested using four organic solvents: dichloromethane (DCM), diethyl ether (DEE), n-pentane, and hexanes. These solvents were

chosen based on previous research on the anticancer and antibacterial effects of the oregano sulphide components of garlic (Allium sativum L.) and onions (Allium cepa L.) DCM and DEE are the solvents most frequently used to extract oregano sulphide from Allium oils. Although n-Pentane and Hexanes are less frequently mentioned solvents for extracting oregano sulphide, studies showing their efficiency with garlic and other Allium spy.

Many studies have been conducted on the oregano sulphide profile of onions as well as the impact of boiling, freezing, freeze drying, and even various homogenization techniques in various solutions on the generation of oregano sulphide in onions.

Unfortunately, little research has been done on the yellow onion's extraction solvent utilized to make onion oil. In order to identify which organic solvent yields the best qualitative and semi-quantitative findings upon analysis by GC-MS, we compared four regularly used organic solvents to extract oregano sulphide in onion oil made from steam distilled yellow onions. Although quantitative yields associated to the extraction solvent have not been published, qualitative identification of the oregano sulphide components in onion oil has been done.

Unsurprisingly, the study did not provide quantitative analysis on steam distilled onion oil. Yet, another article describing the optimization of GC methods for compound identification of volatile organic chemicals recovered from raw onion has also been published.

The aim of this work is Red Onion essential oil extraction for a variety of medicinal, chemical and industrial uses.

Chapter 3: Research Methodology (Materials & Methods)

Materials and Equipment

The following materials and equipment were used while carrying out this research work, such as: red onion, grinding machine, containers, distillation column as mechanism of essential oil extraction, Chloroform, recovery containers, reagents etc.

Sample Collection

The red onion (allium cepa) was purchased from fruit market South bopal, and then transported to the home form grinding and transported to parul University for extraction of oil. 25kg of red onion was purchases from the market. After processing, 23.5kg was used for the extraction of the essential for the variety of the red onion.

Experimental Set-Up

Water bath and steam distillation used to conduct the experiment. The most common technique for separating and extracting essential oils from plants for use in natural products is steam distillation. This occurs when the volatile compounds in the plant material are vaporised by the steam, leading to their eventual condensation and collecting.

Experimental Procedure

I. First took red onions and they grinded with the grinding machine.

II. Then take the grinded onions in 500 ml of glass beaker and measured the weight of it with the help

of weight machine.

III. Then add some water in the beaker and mix the grinded onions with the water

V. Then let the mixture come to room temperature and then add chloroform liquid in that mixture and mix it well and let the mixture stay for 5 to 10 minutes. The oil is soluble chloroform so they mix to

gather.

VI. After that we can see two layers of water and the chloroform so separate the chloroform with the help of separating funnel.

VII. After that we have to do water bath to get the oil.

VIII. For water bath take 1 aluminum vessel and fill the container with distilled water to the required

level then turn on burner and control the temperature near 60 °C to 80 °C. and heat it till 2 to 3 hours until u see the yellow-colored dense liquid and no smell of chloroform.

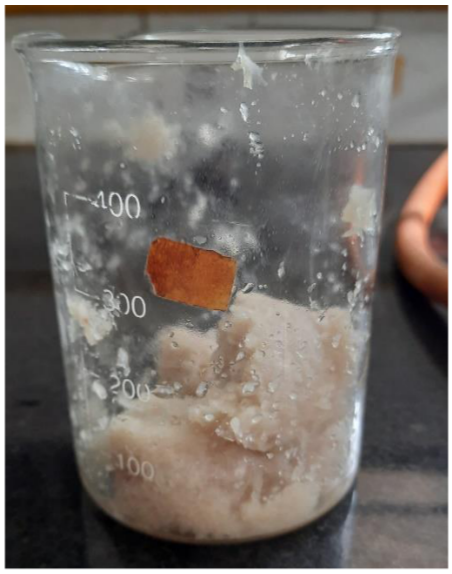
IX. Or we can do steam distillation to evaporate the chloroform and get oil.

PRACTICAL PROCEDURE

(Total 400 gm of paste of onion took)

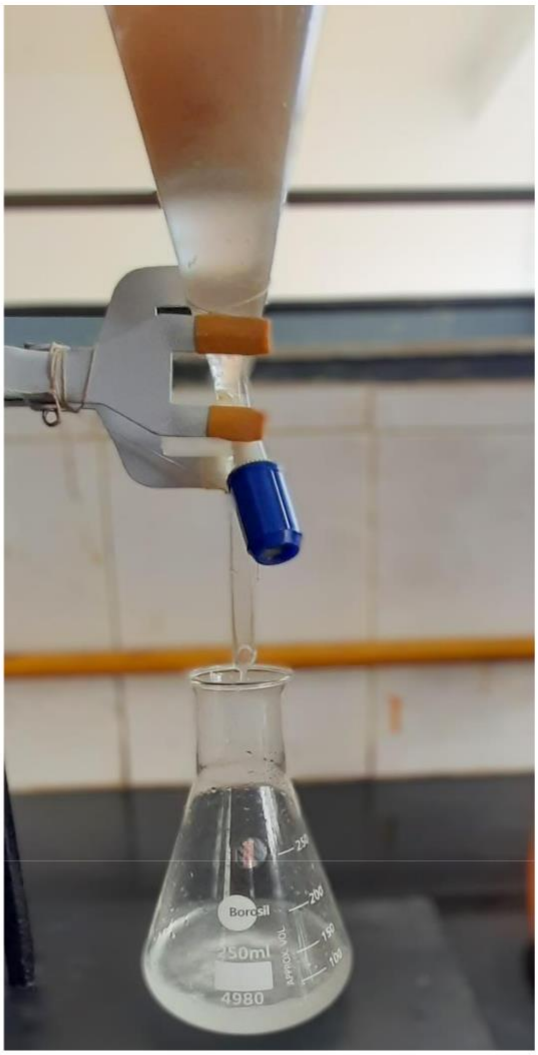
(100 ml of chloroform per 400 gm past20

(After the mixing onion paste and chloroform)



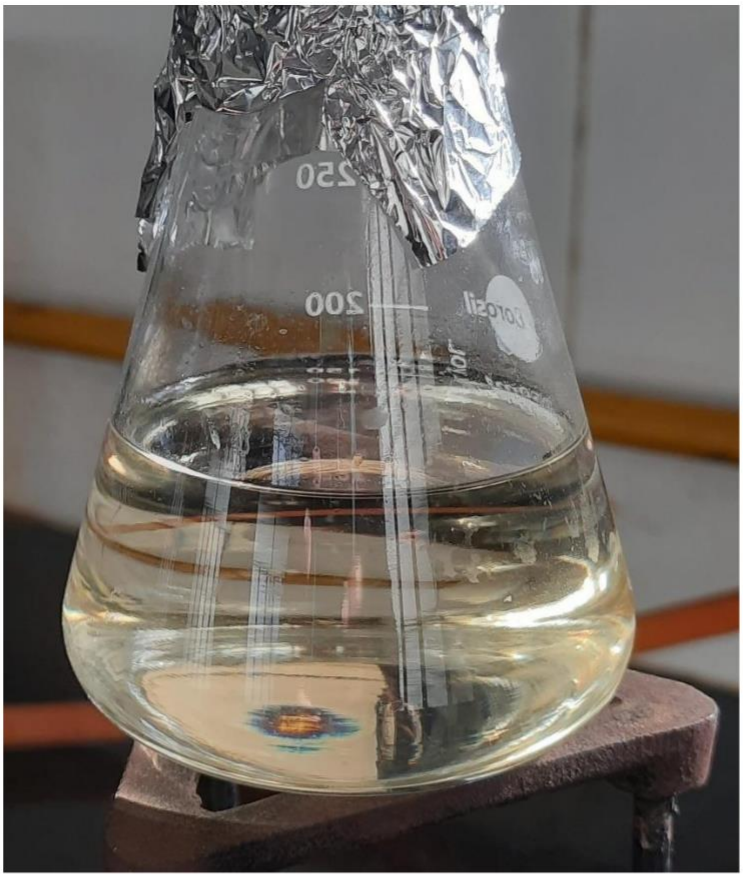
(After filtering the liquid, the rest of the onion)

(Separate the chloroform and water with the help of separating funnel[22]

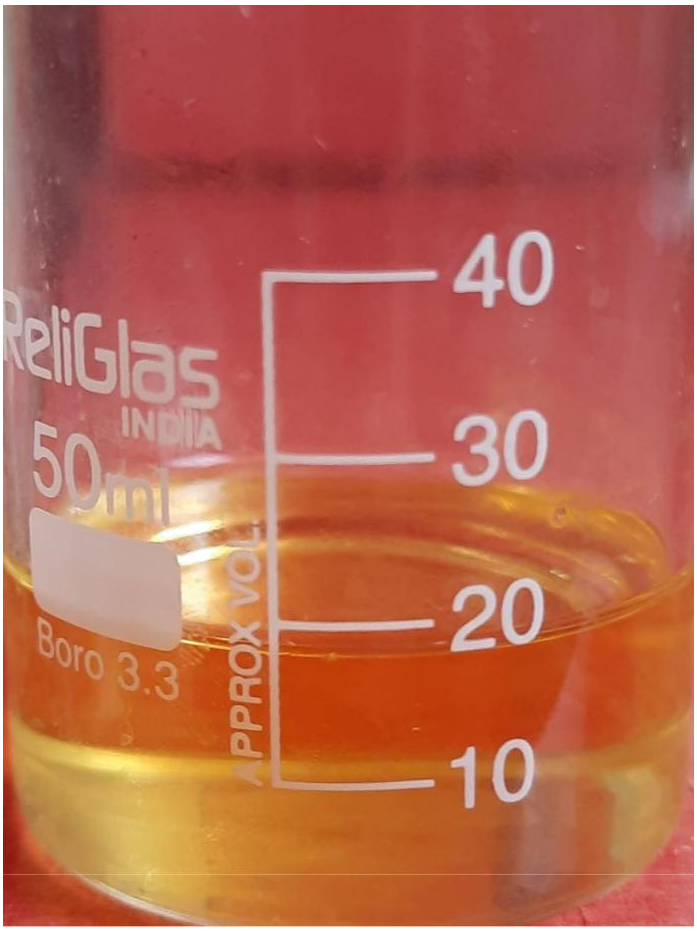


(Separated liquid with oil)

(Water bath)[23]



(after heating on water bath we can see slight yellow color of oil)



(Oil recovered from the experiment)24

Chapter 4: Discussion & End Product Analysis

The following mentioned analysis we can do on the oil:

(i) pH value
(ii) Acid value
(iii) Iodin value
(iv) Refractive Index
(v) Peroxide Value
(vi) Viscosity
(vii) Density and Specific Gravity
(viii) Determination of Flash Point
(ix) Free Fatty Acid Determination (FFA)
(x) Saponification Value of Oil

1) Hydrogen Ion Concentration (pH) value:

The pH of oil determines its relative Acidity or Alkalinity.

There are two (2) methods.

i. Electrometric method (i.e., using pH meter)

ii. Colorimetric method (i.e., using litmus paper).

but here we are using the pH meter method

Procedure:

i. Assemble apparatus and sample

ii. The PH meter was turned on and allow to warm for 15 minutes

iii. The electrode was standardized using standard buffer PH 4 or. 7

iv. 100ml of the oil measured in a measuring cylinder into a 250ml beaker

v. The electrode was immersed into the oil and allowed the lower part of electrode to reach the bottom of the beaker.

vi. Take reading was taken and recorded.

vii. The electrode was removed and cleaned with distilled water.

2) Acid value:

The acid value is determined by directly titrating the oil/fat in an alcoholic medium against standard potassium hydroxide/sodium hydroxide solution.

Procedure:

Mix the oil or melted fat thoroughly before weighing. The mass of the test sample shall be taken based on the color and expected acid value.

Expected Acid Value	Mass of Test portion (gm)	Accuracy of weighing of test portion (gm)
<1	20	0.05
1 to 4	10	0.02
4 to 15	2.5	0.01
15 to 75	0.5	0.001
>75	0.1	0.0002

a) Weigh accurately appropriate amount of the cooled oil sample as mentioned in the above table in a 250 mL conical flask.

b) Add 50 mL of freshly neutralized hot ethyl alcohol and about one ml of phenolphthalein indicator solution. In case of rice bran oil or RBO based blends, add about 1mL of Alkali blue indicator.

c) Heat the mixture for about fifteen minutes in water bath (75-80°C)

In case of Rice bran oil or RBO based blended oils or fats, add 1mL of Alkali blue Indicator after heating.

d) Titrate while hot against standard alkali solution shaking vigorously during the titration.

e) End point using phenolphthalein indicator shall be from colorless to light pink (Persisting for 15 sec.)

f) End point using Alkali blue 6B indicator shall be disappearance of blue color which developed during addition of indicator.

(Note: Noting burette reading after “obtaining dark pink color OR Orangish red” as end point should be avoided as it will lead to erroneous result)

g) The weight of the oil/fat taken for the estimation and the strength of the alkali used for titration shall be such that the volume of alkali required for the titration does not exceed 10mL.

Calculation:

Acid value = 56.1 V*N/ w

Were,

V = Volume in mL of standard potassium hydroxide or sodium hydroxide used

N = Normality of the potassium hydroxide solution or Sodium hydroxide solution; and W = Weight in gm of the sample

3) Iodine Value of the Oil:

Iodine value is a measure of the total number of double bonds present in fats and oils. It is expressed as the number of grams of iodine that will react with the double bonds in 100 grams of fats or oil. It can be determined in fats and oils with thermometric titration, by dissolving a weighed sample in a non-polar solvent and then adding glacial acetic acid

Procedure:

i. Measure 5g of oil into a 500ml flask

ii. Add 20ml of carbon tetrachloride (ccl4) into the flask containing the oil; add 25ml of wiji's reagent solution.

iii. Prepare 9g of iodine in 1lit of glacial acetic acid

iv. Add 10ml of iodine acetic acid solution into the 500ml flask

v. Shake vigorously for 1 minutes

vi. The flask is then stored for 30minutes in a dark locker.

vii. After which, 20 ml of potassium iodide (KI) solution followed by 100ml of distilled water was added into the flask.

viii. The solution was titrated against 0.1N Sodium thiosulphate (Na2SO3)

ix. 0.5ml of starch solution was added after first titration

x. And titrate again with 0.1N (Na2SO3) xi. Do same for blank with distilled water.

4) Refractive Index:

Refractive index indicates the ratio of the velocity of light in vacuum to the velocity of light in the oil, it is generally expressed as the ratio between the sine of the angle of refraction when ray of light of a known wave-length (usually 589.3 mu, the mean of the d-lines of sodium) passes from air into the oil, it is useful for identification purposes and for establishing purity, and also, for observing the progress of reaction, such as catalytic hydrogenation and isomerization. It has been excessively used in analyzing binary esters.

Procedure:

i. The lamp standing behind the refractometer was switched on

ii. The prison box was opened by releasing toggle on the right-hand side and swung to the left

iii. The 2 prisons were cleaned with acetone and cotton wool

iv. 3-5 drops of the oil to be examine was placed onto the fixed prison and the apparatus was closed

v. With the eye on the upper telescope the control knob was turned in front until the field was divided into two (light and dark field)

vi. The border line between the fields may occur colored due to dispersion of the lamp light

vii. The color was eliminated by rotation of the dispersion drum (second knob) until the field appeared of good contras and free from color neither red nor blue

viii. The border line was set exactly on the intersection of the eye piece

ix. The scale reading was observed in the lower telescope and the fourth number behind the point was interpolated.

5) Determination of peroxide value:

The peroxide value (POV) is defined as the reactive oxygen contents expressed in terms of milliequivalents (meq) of free iodine per kilograms of fat. It is determined by titrating iodine liberated from potassium iodide with sodium thiosulphate solution.

Procedure:

1. Take about 0.3 g of fat sample or A ml of the extract containing about 0.3 g of fat into a 250 ml flask with stopper.
2. Remove solvent using rotary evaporator under reduced pressure at 40°C (water-bath temperature).
3. Add 10 ml of CHCl3-CH3COOH mixture and dissolve the fats by shaking.
4. Add 1 ml of saturated Kl solution.
5. Immediately stopper and stand in the dark for 5 min.
6. Add 20 ml of distilled water, then shake.
7. Titrate the liberated iodine with 0.01 N Na2S2O3 solution until light yellow color. Add 1 ml of 1.5% starch solution as indicator and titrate till colorless.
8. Carry out blank test in the same manner without fats.

6) Viscosity:

Viscosity is defined as the force acting on a unit area where the velocity gradient is equal 1 at a given density of the fluid.

Apparatus:

Viscosimeter cup with capillary and ball valve constant temperature bath with stirrer redwood flasks 50ml, stopwatch and thermometer.

Procedure:

i. Fill in the oil into the viscometer cup.

ii. Adjust the temperature of the bath to the desired temperature by heating or adding ice water, use the stirrer for uniform temperature.

iii. When the temperature is constant, allow some fluid to flow out by lifting up the closing ball valve until the tip of the level indicator just touches the surface.

iv. Place the 50cm3 receiver under the opening.

v. By use of a stopwatch, measure the time which it takes to fill the redwood flask up 50cm3 under the opening.

7) Density and Specific Gravity:

We can determine basically the density of solids and liquids. Every essential oil has its required density. It is a physical property used to evaluate the quality of substances. The density of oil reveals the yield and quality of the oil. It is temperature dependent; when the temperature is high, there would be expansion in volume, hence mass remains constant while density reduces. Although density and specific gravity are general physical characteristic used in the classification of fats and oils, neither are highly definitive to characterization except for a few high-density oils like castor oil nor hydrogenated castor oils.

SG = density of substance/standard density of water

Methods of obtaining density and specific gravity

- Hydrometer method
- Pycnometer method (specific gravity bottle or density bottle)

Pycnometer Method

Procedure:

i. Weight of density bottle was measured using the weighing balance.

ii. Bottle and liquid was measured and recorded.

iii. The spills were cleaned off to avoid error.

iv. The weights were compared and recorded.

v. The mass and the bottle volume were obtained.

8) Determination of Flash Point:

Flash point is the lowest temperature corrected to a pressure of 760mmhg of the sample at which application of an ignition source causes the vapor of the sample to become inflammable under specified conditions of test.

Flashpoint makes use of three energies.

i. Heat Energy

ii. Mechanical energy

iii. Electrical energy

Apparatus:

Pinsky Martens closed tester, thermometer (0 – 360°C), fume chamber and filtered sample

Procedure:

i. The flash point cup was cleaned chemically and dried to remove any trace of containable eigenpath or gasoline.

ii. The sample to be tested was measured into the cup up to the mark indicated.

iii. The cup was fit into position in the apparatus and assembled with thermometer and flame.

iv. The heater and stirrer were started and heating was adjusted so the rate of rising is about 5-6 °C.

v. The flash point test was started at 20°C below flashpoint specification of the sample by stopping the stirrer before lowering the flame, raise the flame after a second if there is no flash and continue stirring.

vi. The flash point of the sample is the temperature at which the test flame causes distinct flash in the interior of the cup.

9) Free Fatty Acid Determination (FFA):

Free fatty acid value is an important qualitative parameter in terms of oil quality. Since fats and oils contain some level of free fatty acid (FFA), there will always be an increase in acidity with time during transport and storage. The nutritional value of fat and oil depend, in some respect on the amount of the free fatty acid which develops. The physical and chemical properties of fats and oils are essentially determined by the fatty acid composition of their triglycerides.

Procedures:

i. 2.5g of oil sample was weighed into a conical flask

ii. 100ml of neutralized alcohol was added to it.

iii. 2 drops of phenolphthalein indicator was added.

iv. And was titrated with 0.1N of NaOH until a pink colour change was observed

v. The titter value was recorded for calculations

10) Saponification Value of Oil:

Saponification value represents the number of milligrams of potassium hydroxide required to saponify 1g of fat under the condition specified. It is a measure of the average molecular weight (Or chain length) of all the fatty acids present in the oil.

Procedure:

i. 4g of oil was measured into a conical flask containing 50ml of alcohol potash.

ii. The flask was connected to a heater and heated for 1 hour while shaking.

iii. After 1 hour it was removed, and 2 drops of phenolphthalein was added and pink colour energy

iv. This was titrated using 0.5N hydrochloric acid till the pink colour disappears.

v. The blank (without oil): was done in the same manner with distilled water.

Calculations:

Acid value = 56.1 V*N/ w

Were,

V = Volume in mL of standard potassium hydroxide or sodium hydroxide used

N = Normality of the potassium hydroxide solution or Sodium hydroxide solution; and

W = Weight in gm of the sample

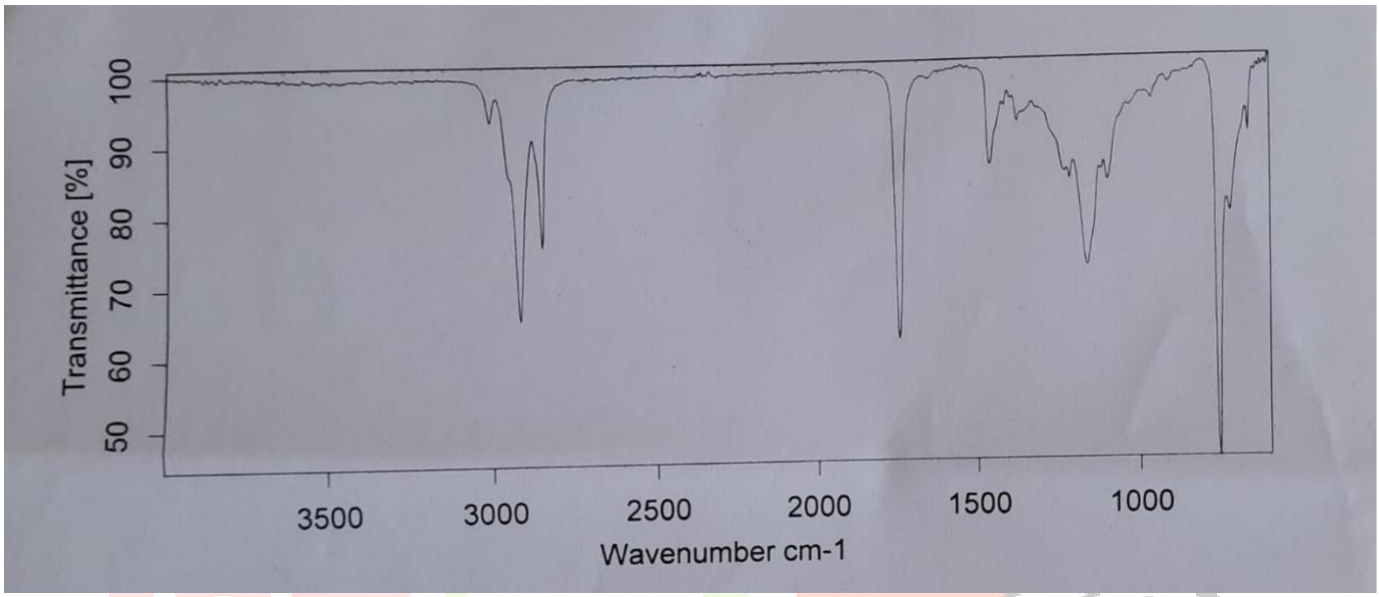
Chapter 5: Summary & Conclusion (RESULTS AND DISCUSSION)

The conclusions of the research to extract red onion (C3H6OS) essential oil for usage in many pharmaceutical, chemical, and industrial applications.

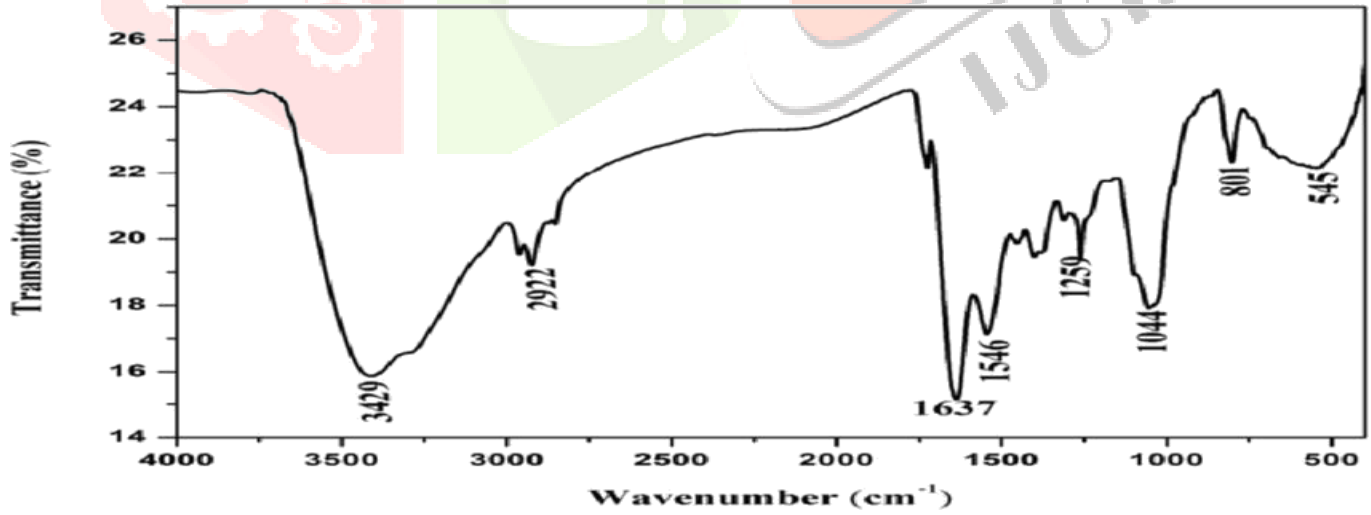
Here are the results of some above-mentioned analysis techniques

1) Fourier Transform Infrared Spectroscopy (FTIR):

Here is the graph of FTIR of sample

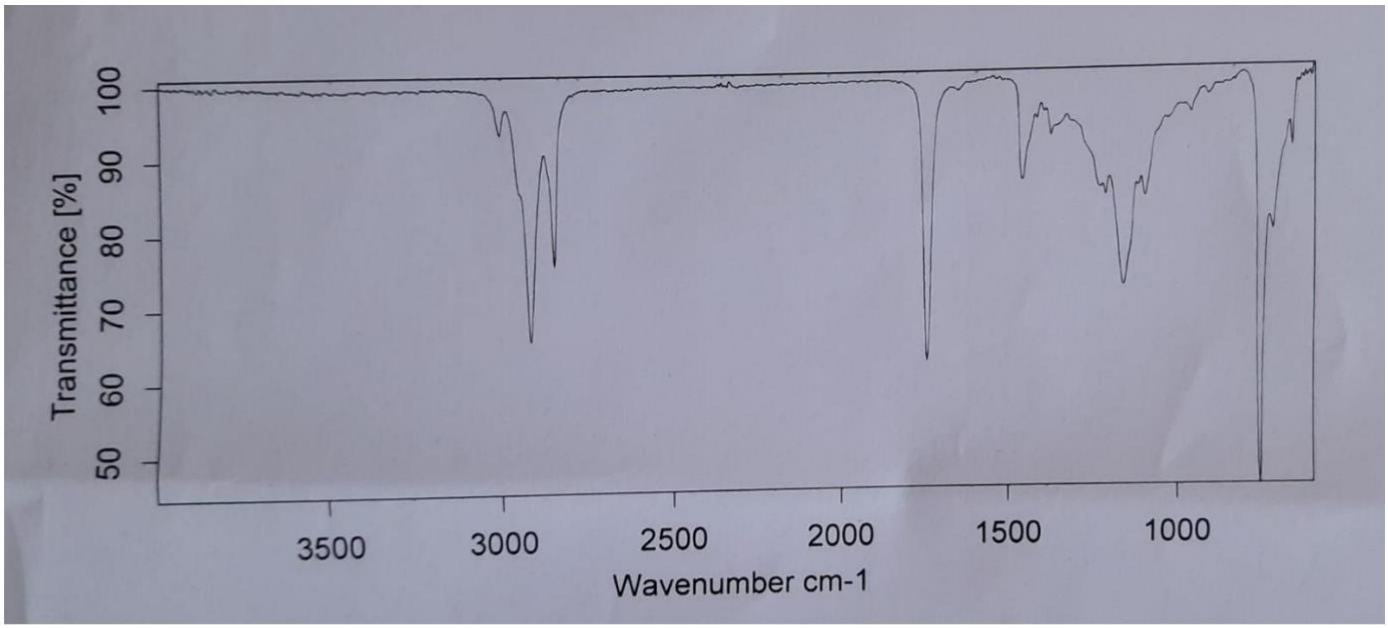


(a) (FTIR graph of the sample by expert)



(b) (FTIR graph of onion oil by expert for comparison)

wavenumber	Abs. intensity	Rel. intensity	Width	Found if threshold	<Shoulder
1990.8845	0.996	0.001	15.9466	0.197716	0
19463.5891	0.996	0.001	9.3838	0.175573	0
1923.3850	0.995	0.003	7.1383	0.419684	0
1899.8999	0.997	0.001	1289.6375	0.117073	0
1844.6118	0.995	0.001	7.0129	0.226586	0
1828.5901	0.993	0.002	6.7740	0.382842	0
1743.4398	0.616	0.384	26.0580	67.879807	0
1670.4408	0.986	0.001	5.3289	0.195006	0
1652.6412	0.983	0.007	2014.3942	0.763154	0
1616.4430	0.992	0.002	2089.1371	0.323573	0
1602.2870	0.993	0.002	2063.9215	0.194964	0
1576.4121	0.995	0.002	6.3867	0.321548	0
1558.6090	0.997	0.002	5.9664	0.260370	0
1539.9119	0.996	0.003	11.4303	0.448638	0
1520.1424	0.994	0.004	6.2469	0.516006	0
1506.9820	0.995	0.001	881.5454	0.176260	0
1460.6299	0.862	0.116	35.5138	18.018589	0
1418.2712	0.943	0.011	1029.9588	0.994854	0
1397.2233	0.953	0.006	691.1737	0.630633	0
1377.1120	0.920	0.037	743.9969	4.774602	0
1231.1120	0.850	0.007	184.9239	0.629115	0
1215.3121	0.838	0.030	10.9469	4.544768	0
1160.8021	0.717	0.283	85.5746	50.144161	0
1118.9875	0.850	0.007	1478.4352	0.611147	0
1098.4846	0.836	0.032	15.3535	4.732804	0
1034.8679	0.939	0.004	2115.5437	0.495645	0
986.5780	0.957	0.001	11.6966	0.187319	0



Wavenumber	Abs. intensity	Rel. intensity	Width	Found if threshold	<Shoulder
965.4987	0.947	0.015	2163.9480	1.923184	0
914.8102	0.970	0.011	16.5619	1.618823	0
887.8954	0.983	0.001	8.8170	0.186760	0
874.4019	0.983	0.005	2553.5459	0.293121	0
856.6282	0.985	0.003	2206.0039	0.321274	0
848.8048	0.986	0.002	1994.4496	0.101531	0
837.2007	0.988	0.004	2048.7203	0.462631	0
755.7569	0.441	0.568	22.6925	98.991562	0
723.0896	0.788	0.035	53.1744	3.212244	0
667.6559	0.899	0.042	7.2109	5.973994	0
646.8585	0.984	0.006	1902.6291	0.677038	0
634.1832	0.989	0.008	1943.8836	0.984837	0
624.4792	0.991	0.010	7.3111	1.565163	0
610.7156	0.992	0.012	1445.7118	1.468208	0

Altra Analytical Laboratories

ALTRA Since 1959

License No. : GATL/04

CERTIFICATE OF ANALYSIS

FORM 50 (RULE 160 D (f) (The Drugs & Cosmetics Act, 1940 and Rules 1945 thereunder)

Test Name	
Description	Yellow coloured liquid.
Identification A By IR	Complies
pH	2.907
Acid value	3.14
Iodine Value	2.64
Refractive Index	1.43
Peroxide Value	1.78

End of Report

Report : In the opinion of undersigned the sample reffered to above is of standard quality with respect to defined in the Act and the rules made thereunder.

ALTRA ANALYTICAL LABORATORIES AHMEDABAD

Note :
1. The test result refer only to the tested sample and applicable parameters. Endorsement of product is neither referred nor implied.
2. Total liability of our institution is limited to the invoice amount / testing charges.
3. This report is not to be reproduced wholly or in part and cannot be used as an evidence in the court of law and should not be used in any adverting media without our special permission in writing.
4. Sample analysis / testing are performed on request of customers and on the sample drawn & submitted by the party for analysis unless otherwise stated.
5. Altra Analytical Laboratories maintains strict confidentiality of all the analysis and test results of sample received and will not reveal this information to third party unless required by the statutory or legal requirement.
6. Perishable samples would be destroyed after three months from the date of report / unless otherwise agreed with the customer. Also retain sample will not be returned unless otherwise agreed in writing.
7. The sample is acceptable by us subject to our general conditions of services which is available on request. Attention is drawn to the limitation of liabilities, indemnification and jurisdictional issues, etc. defined therein.
8. All disputes are subject to AHMEDABAD Jurisdiction.

Here are the following mentioned analysis results:

Test name		Result
(i)	pH value	2.907
(ii)	Acid value	3.14
(iii)	Iodin value	2.64
(iv)	Refractive Index	1.43
(v)	Peroxide Value	1.78

Report: in the opinion of undersigned the sample referred to above is of standard quality of oil with respect to defined in the Act and rules made thereunder.35

CONCLUSION

The essential oil from onions (Allium cepa) has valuable components that are therapeutic for human health, according to a physical and chemical investigation of the oil. Its essential oil's richness cannot be compared to that of any other oil derived from other plants. Also, it may be employed as a starting point in the synthesis of other materials for the creation of medical and drugs.

Since onion oils nourish the hair roots, they are particularly beneficial for hair development. It also contains a lot of antioxidants, which assist to maintain the scalp clear of dandruff and stop hair loss.

The important vitamins, minerals, and antioxidants helps in preventing hair loss and function as a conditioner to keep hair smooth and promote hair development.

Moreover, due to its antibacterial and antifungal qualities, it aids in the healing of cuts and wounds. The bacteria that cause tooth infections are eliminated by onion oils, which also aid in reducing toothaches. Moreover, it is used to treat skin conditions like eczema and acne.

This task also includes figuring out the essential oil of the plant's physical characteristics, such refractive index, density, and viscosity, as well as its chemical characteristics, like iodine value, peroxide value, acid value, saponification value, and free fatty acid content.

These physicochemical properties of the oil serve as helpful points of comparison and as quality benchmarks in business dealings.

Chapter 6: Bibliography/ References

[1] Choi SI, Hong EY, Lee JH, Lee YS, Kim GH (2008) Antioxidant and antimicrobial activities of the ethanol extract of Allium victoriallisL. var. platyphyllum. Food Science andBiotechnology, 17:313-318.

[2] Day AJ, Mellon F, Barron D, Sarrazin G, Morgan MRA, Williamson G (2001) Humanmetabolism of dietary flavonoids: Identification of plasma metabolites of quercetin. FreeRadical Research, 35:941-952.

[3] Dorant E, Van Den Brandt P, Goldbohm RA (1996) A prospective cohort study on therelationship between onion and leek consumption, garlic supplement use and the risk ofcolorectal carcinoma in The Netherlands. Carcinogenesis, 17:477-484.

[4] Dorant E, Van Den Brandt PA, Goldbohm RA, Sturmans F (1996) Consumption of onionsand a reduced risk of stomach carcinoma. Gastroenterology, 110:12-20.

[5] El-Demerdash FM, Yousef MI, Abou El-Naga NI (2005) Biochemical study on thehypoglycemic effects of onion and garlic in alloxan-induced diabetic rats. Food and ChemicalToxicology, 43:57-63.

[6] Glasser G, Graefe EU, Struck F, Veit M, Gebhardt R (2002) Comparison of antioxidativecapacities and inhibitory effects on cholesterol biosynthesis of quercetin and potentialmetabolites. Phytomedicine, 9:33-40.

[7] Goldman IL, Kopelberg M, Debaene JEP, Schwartz BS (1996) Antiplatelet activity in onion(Allium cepa) is sulphur dependent. Thrombosis and Haemostasis, 76:450-452.

[8] Mogren LM, Olsson ME, Gertsson UE (2007) Quercetin content in stored onions (AlliumcepaL.): effects to storage conditions, cultivar, lifting time and nitrogenfertiliser level. Journalof the Science of Food and Agriculture, 87:1595-1602.

[9] Moreno FJ, Corzo-Martinez M, del Castillo MD, Villamiel M (2006) Changes inantioxidant activity of dehydrated onion and garlic during storage. Food ResearchInternational, 39:891-897.

[10] Sakakibara H, Yoshino S, Kawai Y, Terao J (2008) Antidepressant-Like Effect of Onion(Allium cepaL.) powder in a rat behavioural model of depression. Bioscience, Biotechnology,and Biochemistry, 72:94-100.

[11] Slimestad R, Fossen T, Vagen IM (2007) Onions: A source of unique dietary flavonoids.Journal of Agricultural and Food Chemistry, 55:10067-10080.

[12] Tuyns AJ, Kaaks R, Haelterman M (1988) Colorectal-cancer and the consumption of foods- a case-control study in Belgium. Nutrition and Cancer-an International Journal, 11:189-204.

[13] Wang TJ, Gona P, Larson MG, Tofler GH, Levy D, Newton-Cheh C, Jacques PF, RifaiN, Selhub J, Robins SJ, Benjamin EJ, D'Agostino RB, Vasan RS (2006) Multiple biomarkersfor the prediction of first major cardiovascular events and death. New England Journal ofMedicine, 355:2631-2639.

[14] Woo KS, Hwang IG, Kim TM, Kim DJ, Hong AT, Jeong HS (2007) Changes in theantioxidant activity of onion (Allium cepa) extracts with heat treatment. Food Science andBiotechnology, 16:828-831.

[15] Yang J, Meyers KJ, Van der Heide J, Liu RH (2004) Varietal differences in phenoliccontent and antioxidant and antiproliferative activities of onions. Journal of Agricultural andFood Chemistry, 52:6787-6793.

[16] Zheng, C.; Qin, L. Chemical composition of CentellaAsiatica and their bioactivities.Journal of Chinese Integrative medicine, 5, 2007, 348- 351.

[17] G. Griffiths, L. Trueman, T. Crowther, B. Thomas, and B. Smith, “Onions - A globalbenefit to health,” Phyther. Res., vol. 16, no. 7, pp. 603–615, 2002.

[18] R. B. Maude, “Onion diseases,” Epidemiol. Plant Dis., pp. 404–422, 2013.

[19] M. Y. Shon, S. Do Choi, G. G. Kahng, S. H. Nam, and N. J. Sung, “Antimutagenic,antioxidant and free radical scavenging activity of ethyl acetate extracts from white, yellowand red onions,” Food Chem. Toxicol., vol. 42, no. 4, pp. 659–666, 2004.

[20] B. N. Singh et al., “Polyphenolics from various extracts/fractions of red onion (Alliumcepa) peel with potent antioxidant and antimutagenic activities,” Food Chem. Toxicol., vol. 47,no. 6, pp. 1161–1167, 2009.

[21] N. Benkeblia, “Antimicrobial activity of essential oil extracts of various onions (Alliumcepa) and garlic (Allium sativum),” vol. 37, pp. 263–268, 2004.

[22] C. Ye, D. Dai, and W. Hu, “Antimicrobial and antioxidant activities of the essential oilfrom onion (Allium cepa L.),” Food Control, vol. 30, no. 1, pp. 48–53, 2013.

[23] M. P. Induja and R. V Geetha, “Antimicrobial activity of Allium cepa against bacteriacausing enteric infection,” Drug Invent. Today, vol. 10, no. 12, pp. 2489–2492, 2018.

[24] K. A. Lee et al., “Antioxidant activities of onion (Allium cepa L.) peel extracts producedby ethanol, hot water, and subcritical water extraction,” Food Sci. Biotechnol., vol. 23, no. 2,pp. 615–621, 2014.

[25] M. Fragis, A. I. Murayyan, and S. Neethirajan, “Cytotoxic activity and anti-cancerpotential of Ontario grown onion extracts against breast cancer cell lines,” Funct. Foods Heal.Dis., vol. 8, no. 3, pp. 159–174, 2018.

[26] H. Wu and B. Xu, “Inhibitory effects of onion against α-glucosidase activity and itscorrelation with phenolic antioxidants,” Int. J. Food Prop., vol. 17, no. 3, pp. 599–609, 2014.

[27] F. J. Vazquez-Armenta, M. R. Cruz-Valenzuela, and J. F. Ayala-Zavala, Onion (Alliumcepa) essential oils. Elsevier Inc., 2015.

[28] M. Søltoft, J. H. Christensen, J. Nielsen, and P. Knuthsen, “Pressurised liquid extractionof flavonoids in onions. Method development and validation,” Talanta, vol. 80, no. 1, pp. 269–278, 2009.

[29] J. Santas, R. Carbó, M. H. Gordon, and M. P. Almajano, “Comparison of the antioxidantactivity of two Spanish onion varieties,” Food Chem., vol. 107, no. 3, pp. 1210–1216, 2008.

[30] K. G. Martino and D. Guyer, “Supercritical fluid extraction of quercetin from onion skins,”J. Food Process

Eng., vol. 27, no. 1, pp. 17–28, 2004.

[31] C.-L. Ye and Y.-F. Lai, "Supercritical CO 2 Extraction Optimization of Onion Oil UsingResponse Surface Methodology," Chem. Eng. Technol., vol. 35, no. 4, pp. 646– 652, 2012.

[32] M. J. Ko, C. I. Cheigh, S. W. Cho, and M. S. Chung, "Subcritical water extraction offlavonol quercetin from onion skin," J. Food Eng., vol. 102, no. 4, pp. 327–333, 2011.

[33] U. Kaatze and V. Uhlendorf, "The dielectric properties of water at microwavefrequencies," Zeitschrift fur Phys. Chemie, vol. 126, no. 2, pp. 151–165, 1981.

[34] H. Zill-e-huma, Microwave Hydro-diffusion and gravity: a novel technique forantioxidants extraction to cite this version: HAL Id: tel-00547428 Zill-e-Huma. 2010.

[35] M. N. Braimah, A. N. Anozie, and O. J. Odejobi, "Utilization of Response SurfaceMethodology (RSM) in the Optimization of Crude Oil Refinery," J. Multidiscip. Eng. Sci.Technol., vol. 3, no. 3, pp. 4361–4369, 2016.

[36]. Rose, P.; Whiteman, M.; Moore, P.K.; Zhu, Y.Z. Bioactive S-Alk (En)Yl CysteineSulfoxide Metabolites in the Genus Allium: The Chemistry of Potential Therapeutic Agents.Nat. Prod. Rep. 2005, 22, 351. [Crossreff] [PubMed]

[37]. Smith, R.L.; Cohen, S.M.; Doull, J.; Feron, V.J.; Goodman, J.I.; Marnett, L.J.;Portoghese, P.S.; Waddell, W.J.; Wagner, B.M.; Adams, T.B. GRAS Flavoring Substances 22.Flavor. Subst. 2005, 22, 24–62.

[38] Khalifa, E.S.; Hala, A.O. Onion Juice (Allium Cepa L.), a New Topical Treatment forAlopecia Areata. J. Dermatol. 2002, 29, 343–346.

[39]. Gao, Y.; Wu, S.; Sun, Y.; Cong, R.; Xiao, J.; Ma, F. Effect of Freeze Dried, Hot Air Driedand Fresh Onions on the Composition of Volatile Sulfocompounds in Onion Oils. Dry.Technol. 2019, 37, 1427–1440. [CrossRef]

[40]. Mondy, N.; Naudin, A.; Christides, J.P.; Mandon, N.; Auger, J. Comparison of GC-MSand HPLC for the Analysis of Allium Volatiles. Chromatographia 2001, 53, S356–S360.[CrossRef]

[41]. Boelens, M.H.; de Valois, P.J.; Wobben, H.J.; van der Gen, A. Volatile FlavorCompounds from Onion. J. Agric. Food Chem. 1971, 19, 984–991. [CrossRef]

[42]. D'auria, M.; Racioppi, R. HS-SPME-GC-MS Analysis of Onion (Allium Cepa L.) andShallot (Allium Ascalonicum L.). Food Res. 2017, 1, 161–165. [CrossRef]

[43]. Wardencki, W.; Michulec, M.; Curyło, J. A Review of Theoretical and Practical Aspectsof Solid-Phase Microextraction in Food Analysis. Int. J. Food Sci. Technol. 2004, 39, 703–717. [CrossRef]

[44]. Falaki, F. Sample Preparation Techniques for Gas Chromatography. In GasChromatography—Derivatization, Sample Preparation, Application; IntechOpen: London,UK, 2019; pp. 1–30. [CrossRef]

[45]. Tocmo, R.; Lin, Y.; Huang, D. Effect of Processing Conditions on the Organosulfides ofShallot (Allium Cepa L. Aggregatum Group). J. Agric. Food Chem. 2014, 62, 5296–5304.[CrossRef]

[46]. Abe, K.; Hori, Y.; Myoda, T. Volatile Compounds of Fresh and Processed Garlic(Review). Exp. Ther. Med. 2020, 19, 1585–1593. [CrossRef]

[47]. Lanzotti, V. The Analysis of Onion and Garlic. J. Chromatogr. A 2006, 3–22. [CrossRef][PubMed]

[48]. Augusti, K.T. Therapeutic Values of Onion (Allium Cepa L.) and Garlic (Allium SativumL.). Indian J. Helminthol. 1996, 34, 634–640.

[49]. Tocmo, R.; Wu, Y.; Liang, D.; Fogliano, V.; Huang, D. Boiling Enriches the LinearPolysulfides and the Hydrogen Sulfide-Releasing Activity of Garlic. Food Chem. 2017, 221,1867–1873. [CrossRef]

[50]. Kuo, M.-C. Volatile Constituents of Solvent Extracts of Welsh Onions (AlliumFistulosum L. Variety Maichuon) and Scallions (A. Fistulosum L. Variety Caespitosum). J.Agric. Food Chem. 1992, 40, 1906–1910. [CrossRef]

[51]. Calvey, E.M.; Matusik, J.E.; White, K.D.; Betz, J.M.; Block, E.; Littlejohn, M.H.;Naganathan, S.; Putman, D. Off-Line Supercritical Fluid Extraction of Thiosulfinates fromGarlic and Onion. J. Agric. Food Chem. 1994, 42, 1335–1341. [CrossRef]

[52]. Kubec, R.; Drhová, V.; Velíšek, J. Thermal Degradation of S -Methylcysteine and ItsSulfoxide Important Flavor Precursors of Brassica and Allium Vegetables. J. Agric. FoodChem. 1998, 46, 4334–4340. [CrossRef]

[53]. Zalepugin, D.Y.; Tilkunova, N.A.; Chernyshova, I.V. Stability of Thiosulfinates fromGarlic (Allium Sativum L.) Supercritical Extracts in Polar and Nonpolar Solvents. Russ. J.Phys. Chem. B 2015, 9, 1032–1042. [CrossRef]

[54]. Masood, F.; Malik, A. Cytotoxic and Genotoxic Potential of Tannery WasteContaminated Soils. Sci. Total Environ. 2013, 444, 153–160. [CrossRef] [PubMed]

[55]. Bora, K.; Sharma, A. Phytoconstituents and Therapeutic Potential of Allium CepaLinn.—A Review. Pharmacogn. Rev. 2009, 3, 170–180.

[56]. Ramirez, D.A.; Locatelli, D.A.; González, R.E.; Cavagnaro, P.F.; Camargo, A.B.Analytical Methods for Bioactive Sulphur Compounds in Allium: An Integrated Review andFuture Directions. J. Food Compos. Anal. 2016, 61, 4–19. [CrossRef]

[57]. Arnault, I.; Mondy, N.; Cadoux, F.; Auger, J. Possible Interest of Various SampleTransfer Techniques for Fast Gas Chromatography–Mass Spectrometric Analysis of TrueOnion Volatiles. J. Chromatogr. A 2000, 896, 117–124. [CrossRef]

[58]. Japanese Association of Oil Chemists: Standard methods of oil analysis in Japan, (1972)2(4): 12-71.Pearson, D. (1976). The chemical analysis of foods (7th Ed.): 494-495.

[59]. In Vitro Antioxidant, Antipathogenicity and Cytotoxicity Effect of Silver Nanoparticles Fabricated by Onion (Allium cepa L.) Peel Extract March 2020BioNanoScience 10(49) DOI:10.1007/s12668-019-00691-3