



THE RESERCH IN

"DETERMINATION OF SAPONIFICATION NUMBER IN OLIVE OIL"

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جميع الحقوق محفوظة

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To my father.
To my mother.
To my family.
To my teachers in all my education levels.
To every one who help me.
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ABSTRACT

This test is intended for the evaluation of saponification value of olive oils to be performed on specialty soap.

The samples is solubilized in alcoholic potassium hydroxide and refluxed. Phenolphthalein indicator is added to the solution. The solution is titrated with hydrochloric acid until the faint pink color permanently disappears. This procedure is carried out concurrently for samples and a blank.

After calculation of saponification number of the samples i compared the result with the normal range for saponification number of olive oil to identity the purity of olive oil.

1. INTRODUCTION

1.1 Oil

An oil is any substance that is in a viscous liquid state ("oily") at ambient temperatures or slightly warmer, and is both hydrophobic (immiscible with water, literally "water fearing") and lipophilic (miscible with other oils, literally "fat loving"). This general definition includes compound classes with otherwise unrelated chemical structures, properties, and uses, including vegetable oils, petrochemical oils, and volatile essential oils. Oil is a nonpolar substance.

Types of oils

Mineral oils

All rocks, with their high carbon and hydrogen content, can be traced back to organic sources. Mineral oils, found in porous rocks underground, are no exception, as they were originally the organic material, such as dead plankton, accumulated on the seafloor in geologically ancient times. Through various geochemical processes this material was converted to mineral oil, or petroleum, and its components, such as kerosene, paraffin waxes, gasoline, diesel and such. These are classified as mineral oils as they do not have an organic origin on human timescales, and are instead derived from underground geologic locations, ranging from rocks, to underground traps, to sands.

Other oily substances can also be found in the environment, the most well-known being tar, occurring naturally underground or, where there are leaks, in tar pits . Others include asphalt.

Petroleum and other mineral oils, (specifically labelled as petrochemicals), have become such a crucial resource to human civilization in modern times they are often referred to by the ubiquitous term of 'oil' itself.

Organic oils

Oils are also produced by plants, animals and other organisms through organic processes, and these oils are remarkable in their diversity. Oil is a somewhat vague term to use chemically, and the scientific term for oils, fats, waxes, cholesterol and other oily substances found in living things and their secretions, is lipids.

Lipids, ranging from waxes to steroids, are somewhat hard to characterize, and are united in a group almost solely based on the fact that they all repel, or refuse to dissolve, in water, and are however comfortably miscible in other liquid lipids. They also have a high carbon and hydrogen content, and are considerably lacking in oxygen compared to other organic compounds.

As a biochemist ,the most common application of oil is a Food oil.

Food oils

Many edible vegetable and animal oils, and also fats, are used for various purposes in cooking and food preparation. In particular, many foods are fried in oil much hotter than boiling water. Oils are also used for flavoring and for modifying the texture of foods e.g Stir Fry.

Health advantages are claimed for a number of specific oils such as omega 3 oils (fish oil, flaxseed oil, etc) and evening primrose oil. Trans fats, often produced by hydrogenating vegetable oils, are known to be harmful to health.

1.2. Lipid

Lipids are molecules which is not water soluble since they more closely resemble hydrocarbons. Included in this class are fats, oils, some vitamins and hormones, and an important part of cell membranes and nerve linings. They serve as energy storage, structural molecules, and starter materials for other important molecules.

Chain lengths of the fatty acids in naturally occurring triglycerides can be of varying lengths but 16, 18 and 20 carbons are the most common. Natural fatty acids found in plants and animals are typically composed only of even numbers of carbon atoms due to the way they are bio-synthesised from acetyl CoA.

Most natural fats contain a complex mixture of individual triglycerides; because of this, they melt over a broad range of temperatures. Cocoa butter is unusual in that it is composed of only a few triglycerides, one of which contains palmitic, oleic and stearic acids in that order. This gives rise to a fairly sharp melting point, causing chocolate to melt in the mouth without feeling greasy.

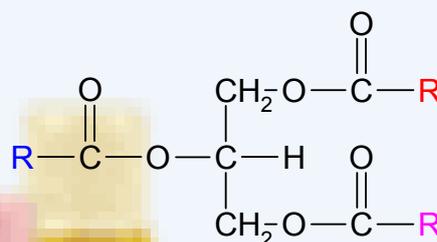


Fig 1.2.2 \ Structure of Triacylglycerols.

Glycerol

Glycerol has three hydrophilic alcoholic hydroxyl groups that are responsible for its solubility in water and its hygroscopic nature.

synthetic glycerol was mainly manufactured at an industrial scale from epichlorohydrin.[citation needed] Since glycerol forms the backbone of triglycerides, it is produced on saponification or transesterification. Soap-making and biodiesel production are respective examples.

Since glycerol has three -OH groups, it can react with three molecules of carboxylic acid to form a triester.

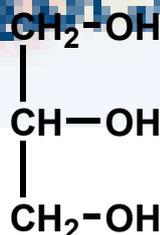


Fig 1.2.3 \ Structure of Glycerol.

The Fatty Acids

Fatty acids are aliphatic monocarboxylic acids derived from or contained in esterified form in an animal or vegetable fat, oil or wax. Natural fatty acids commonly have a chain of 4 to 28 carbons (usually unbranched and even numbered), which may be saturated or unsaturated. By extension, the term is sometimes used to embrace all acyclic aliphatic carboxylic acids. Fatty acids can be saturated and unsaturated, depending on double bonds. In addition, they also differ in length.

- Saturated fatty acids

Saturated fatty acids do not contain any double bonds or other functional groups along the chain. The term "saturated" refers to hydrogen, in that all carbons (apart from the carboxylic acid [-COOH] group) contain as many hydrogens as possible. In other words, the omega (ω) end contains 3 hydrogens (CH₃-), and each carbon within the chain contains 2 hydrogen atoms.

- Unsaturated fatty acids:

Unsaturated fatty acids are of similar form, except that one or more alkenyl functional groups exist along the chain, with each alkene substituting a single-bonded "-CH₂-CH₂-" part of the chain with a double-bonded "-CH=CH-" portion.

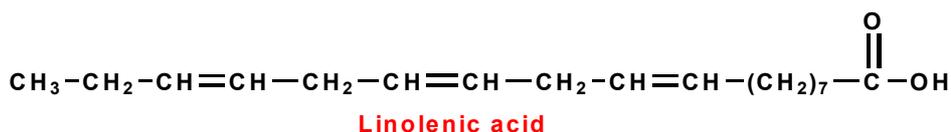
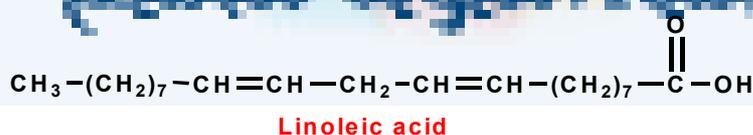
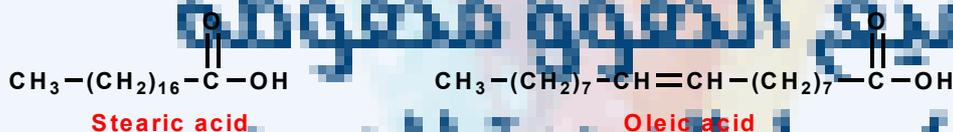


Fig 1.2.4 \ Chemical structures of several fatty acids.

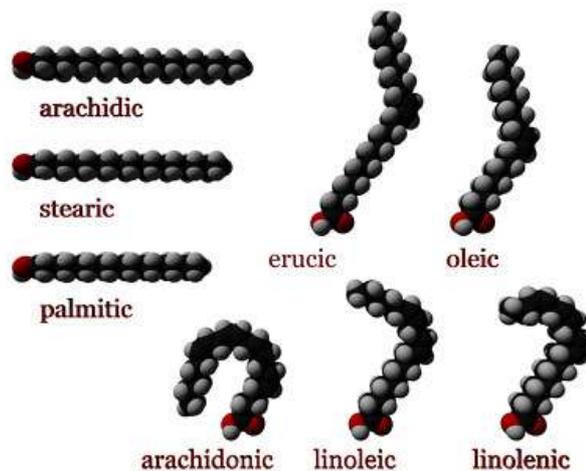


Fig 1.2.5 \ Three dimensional representations of several fatty acids.

Simple triglycerides contain the same fatty acid in all three positions; mixed triglycerides contain two or three different fatty acids

Fatty acids are carboxylic acids with from 4 to 20 carbons in the chain. The chain can be saturated (only single bonds) or unsaturated (one or more double bonds in the chain), Saturated are usually solid at room temperature, unsaturated are usually liquid

The difference between fats and oils has to do with the number of unsaturated fatty acids present. Butter, lard, and “Crisco” have mostly saturated fats. Vegetable oils have a much higher concentration of unsaturated fats.

Saturated versus Unsaturated Fatty Acids

When the carbon chain (excluding the C=O bond) contains single bonds only, the fatty acid is known as a saturated fatty acid, and the triacylglycerol thus becomes a saturated fat.

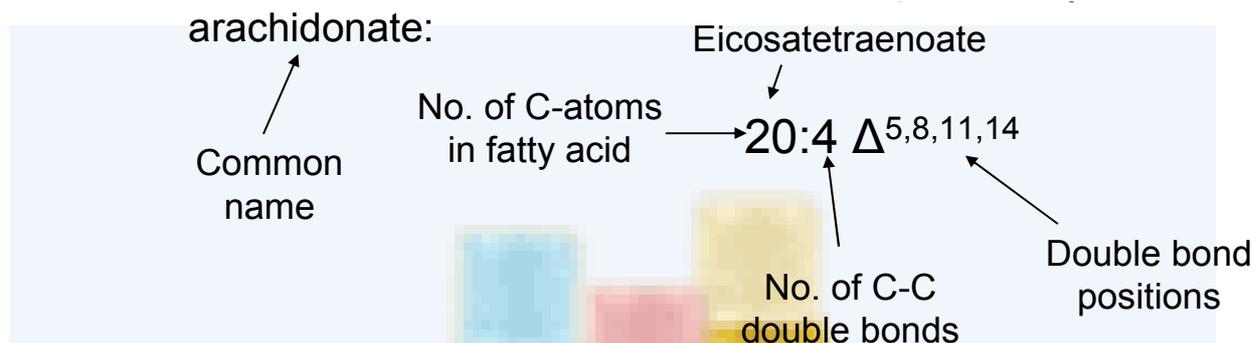
When the carbon chain contains one or more C=C double bonds, the fatty acid becomes an unsaturated fatty acid, and the triacylglycerol thus becomes an unsaturated fat.

IUPAC naming

One double bond – monounsaturated, two or more double bonds – polyunsaturated.

Positions of double bonds indicated by Δ^n (n indicates the lower-number carbon of each double bond).

Shorthand notation: uses two numbers separated by colon, e.g.



1.3 Olive oil

Olive oil is a fruit oil obtained from the olive (*Olea europaea*; family Oleaceae along with lilacs, jasmine and ash trees), a traditional tree crop of the Mediterranean Basin. It is commonly used in cooking, cosmetics, pharmaceuticals, and soaps and as a fuel for traditional oil lamps. Olive oil is healthier than other sources of alimentary fat because of its high content of monounsaturated fat (mainly oleic acid) and polyphenols.

It has several different grades, determined by the acid content. The most prized is extra virgin, which must contain 0 to 1 percent acidity. When the acid climbs to between 1 and 2 percent, the grade drops to virgin olive oil. At three percent acidity, oil is classified as "semi fine". After semi fine, the next level is pure olive oil. Pure olive oil is judged not only by acidity but by its processing method and falls well below extra virgin or virgin in style, color and flavor.

Olive Oil Production

Olive oil production has a mystique that, due to the expansion of worldwide demand, producers are working to clarify. Oil origin, cold pressed or heat processed and oil blending are just a few of the

questions retailers must consider in order to justify the hefty price stickers most oils carry.

Processing olive oil is a multi-step technique. Within 24 to 48 hours of picking, the olives are pressed into a paste. Next, the oil is separated from the paste by centrifugation. This also removes any naturally occurring water. This process is called cold pressing. The first pressing extracts extra virgin and virgin oils. The oil is then graded by acidity testing. Once the first press oil has been extracted from the olive paste, second and third pressings are done to produce pure, light and pumace oils. With each subsequent pressing, heat and solvents are added to extract as much of the oil as possible.

The next step in olive oil production is more complicated and a true art form. The oil maker will blend different oils to reach his ideal of color and fruit. Because oils are mixed together to achieve balance and style, judging oil by the country of origin has passed into legend. Nowadays, oils from all growing regions and countries can be blended together to produce tastes and styles that have specific uses. However, it is still true that the better the quality of the oils used in the blend, the better the finished product.

Storing Olive Oil

Olive oil should be used within the first year of pressing. Once opened, it is recommended to use the oil within 3 months for optimum flavor. Olive oil will become rancid if not handled properly. It does not improve with age. It is best not to purchase large amounts, unless it will be used quickly.

Industrial grades

The several oils extracted from the olive fruit can be classified as:

- *Virgin* means the oil was produced by the use of physical means and no chemical treatment. The term virgin oil referring to production is different from Virgin Oil on a retail label (see next section).
- *Refined* means that the oil has been chemically treated to neutralize strong tastes (characterized as defects) and neutralize the acid content (free fatty acids). Refined oil is commonly regarded as lower quality than virgin oil; the retail labels extra-virgin olive oil and virgin olive oil cannot contain any refined oil.
- *Pomace* olive oil means oil extracted from the pomace using chemical solvents—mostly hexane—and by heat.

Quantitative analysis can determine the oil's acidity, defined as the percent, measured by weight, of free oleic acid it contains. This is a measure of the oil's chemical degradation; as the oil degrades, more fatty acids are freed from the glycerides, increasing the level of free acidity and thereby increasing rancidity. Another measure of the oil's chemical degradation is the organic peroxide level, which measures the degree to which the oil is oxidized, another cause of rancidity.

In order to classify it by taste, olive oil is subjectively judged by a panel of professional tasters in a blind taste test. This is also called its organoleptic quality.

Food energy per 100g	3700 kJ (890 kcal)
Melting point	-6.0 °C (21 °F)
Boiling point	300 °C (570 °F)
Smoke point	190 °C (375 °F) (virgin) 210 °C (410 °F) (refined)
Specific gravity at 20 °C	0.9150–0.9180
Viscosity at 20 °C	84 cP
Refractive index	1.4677–1.4705 (virgin and refined) 1.4680–1.4707 (pomace)
Iodine value	75–94 (virgin and refined) 75–92 (pomace)
Acid value	maximum: 6.6 (refined and pomace) 0.6 (extra-virgin)
Saponification value	184–196 (virgin and refined) 182–193 (pomace)
Peroxide value	20 (virgin) 10 (refined and pomace)

Table 1.3.1 \ Properties of olive oil.

TASTING OILS

Olive oil tasting has become a regular event in food circles. While diehard olive oil aficionados sip it straight from small cups, looking for levels of complexity and flavors, dipping good crusty bread into top quality, highly flavorful oils can be a very pleasant way to pass the cocktail hour or warm your crowd up for a Mediterranean dinner. Each of these are distinctive tastes and will come through in extra virgin or virgin olive oils:

Fruity: Oil with “fruity taste” is reminiscent of fresh sound fruit with a very distinct olive taste.

Sweet: not sugary- a pleasant sweetish olive taste, a taste of young tender ripe fruit.

Peppery: Spicy tones that give a slightly prickly feeling to the taste buds.

Green: Green in color with a slight taste of young mown grass, not sweet.

Olive oil extraction

The most traditional way of making olive oil is by grinding olives. Green olives produce bitter oil, and overly ripened olives produce rancid oil, so care is taken to make sure the olives are perfectly ripened. First the olives are ground into an olive paste using large millstones. The olive paste generally stays under the stones for 30–40 minutes. The oil collected during this part of the process is called virgin oil. After grinding, the olive paste is spread on fibre disks, which are stacked on top of each other, then placed into the press.

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Human health

Evidence from epidemiological studies suggests that a higher proportion of monounsaturated fats in the diet is linked with a reduction in the risk of coronary heart disease.

This is significant because olive oil is considerably rich in monounsaturated fats, most notably oleic acid.

Carbohydrates	0 g
Fat	100 g
- saturated	14 g
- monounsaturated	73 g
- polyunsaturated	11 g
- omega-3 fat	<1.5 g
- omega-6 fat	3.5-21g
Protein	0 g
Vitamin E 14 mg	93%
Vitamin K 62 µg	59%
Energy 890 kcal 3700 kJ	

Table 1.3.2 \ Nutritional value per 100 g of olive oil.

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1.4. Identification and differentiation of fat

Acid value (AV)

The amount of free acid present in fat as measured by the mg of KOH needed to neutralize it. "as the glycerides in fat slowly decompose the acid value increases"
important as first quick characterisation of fat quality.

Iodine No (IN)

Measure of the degree of unsaturation of an oil, fat, or wax; the amount of iodine, in grams, that is taken up by 100 grams of the oil, fat, or wax.

Hydroxyl Number (OHN)

Number reflects the contents of hydroxy fatty acids, fatty alcohols, mono-and diacylglycerols and free glycerol

Saponification no. (SN)

The amount of alkali necessary to saponify a definite quantity of the sample. It is expressed as the number of mg of KOH required to saponify 1 gram of the sample fat or oil.
convert one gram of the fat completely into glycerin and potassium soap

1.5. Soap

Soap is a surfactant used in conjunction with water for washing and cleaning that historically comes in solid bars but also in the form of a thick liquid.

Historically, soap has been composed of sodium (soda ash) or potassium (potash) salts of fatty acids derived by reacting fat with lye in a process known as saponification. The fats are hydrolyzed by the base, yielding glycerol and crude soap.

Many cleaning agents today are technically not soaps, but detergents, which are less expensive and easier to manufacture.

Soapmaking

The most popular soapmaking process today is the cold process method, where fats such as olive oil react with lye. Soapmakers sometimes use the melt and pour process, where a premade soap base is melted and poured in individual molds. While some people think that this is not really soap-making, the Hand Crafted Soap Makers Guild does recognize this as a legitimate form of soap making or soap crafting. Some soapers also practice other processes, such as the historical hot process, and make special soaps such as clear soap (glycerin soap), which must be made through the melt and pour process.

Handmade soap differs from industrial soap in that, usually, an excess of fat is sometimes used to consume the alkali (superfatting), and in that the glycerin is not removed leaving a naturally moisturising soap and not pure detergent.

Superfatted soap, soap which contains excess fat, is more skin-friendly than industrial soap; though, if not properly formulated, it can leave users with a "greasy" feel to their skin. Often, emollients such as jojoba oil or shea butter are added 'at trace' (the point at which the saponification process is sufficiently advanced that the soap has begun to thicken), after most of the oils have saponified, so that they remain unreacted in the finished soap. Superfatting can also be accomplished through a process called superfat discount, where, instead of putting in extra fats, the soap maker puts in less lye.

Soapmaking from fat

Soap is derived from either vegetable or animal fats. Sodium tallowate, a common ingredient in many soaps, is in fat derived from rendered beef fat. Soap can also be made of vegetable oils, such as palm oil, and the product is typically softer. If soap is made from pure olive oil it may be called Castile soap or Marseille soap. Castile is also sometimes applied to soaps with a mix of oils, but a high percentage of olive oil.

An array of oils and butters are used in the process such as olive, coconut, palm, cocoa butter, hemp oil and shea butter to provide different qualities. For example, olive oil provides mildness in soap; coconut oil provides lots of lather; while coconut and palm oils provide hardness. Most common, though, is a combination of coconut, palm, and olive oils.

1.6. Saponification

A reaction in which an ester is heated with an alkali, such as sodium hydroxide, producing a free alcohol and an acid salt, especially alkaline hydrolysis of a fat or oil to make soap.

In chemistry

Saponification is the hydrolysis of an ester under basic conditions to form an alcohol and the salt of a carboxylic acid. Saponification is commonly used to refer to the reaction of a metallic alkali (base) with a fat or oil to form soap. Saponifiable substances are those that can be converted into soap.

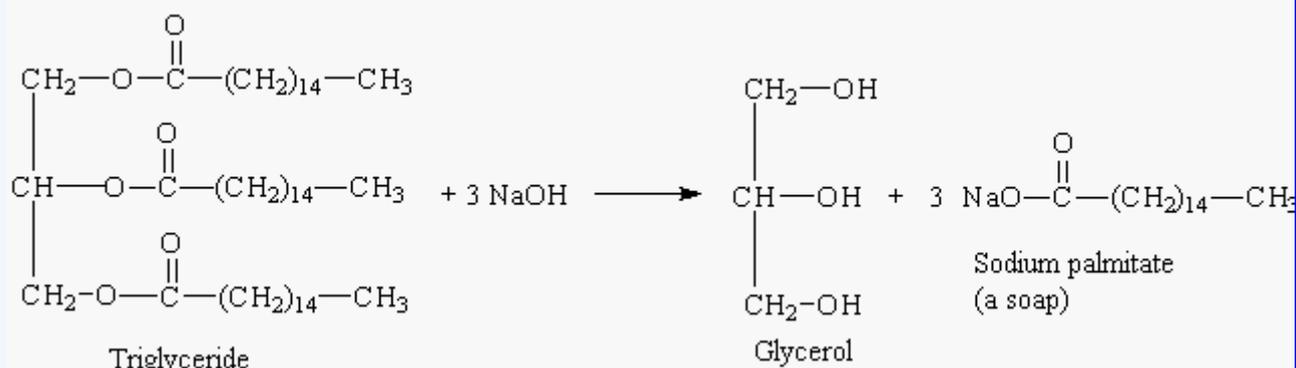


Fig 1.6.1 \ Reaction of Sodium hydroxide with fat to form soap.

Sodium hydroxide (NaOH) is a caustic base. If NaOH is used a hard soap is formed, whereas when potassium hydroxide (KOH) is used, a soft soap is formed. Vegetable oils and animal fats are fatty esters in the form of triglycerides. The alkali breaks the ester bond and releases the fatty acid and glycerol. If necessary, soaps may be precipitated by salting it out with saturated sodium chloride.

Saponification in fire extinguishers

Fires involving cooking fats and oils (classified as Class F) burn hotter than other typical combustible liquids, rendering a standard class B extinguisher ineffective. Such fires should be extinguished with a wet chemical extinguisher. Extinguishers of this type are designed to extinguish cooking fats and oils through saponification. The extinguishing agent rapidly converts the burning substance to a non-combustible soap.

The importance of saponification

- Saponification number is an indication of the amount of fatty saponifiable material in compounded oil.
- It gives information concerning the character of the fatty acids of the fat and in particular concerning the solubility of their soaps in water.
- The higher the Saponification number of a fat free from moisture and unsaponifiable matter, the more soluble the soap that can be made from it.
- The information is of special importance to soap makers.

When hydrolysis happens due to a strong base, saponification happens, just as in esters before. In this case, three soap molecules are made:

These soaps are hard or soft depending on the amount of unsaturation in the carbon chains.

Action of Soap (How do soaps work?)

With a polar head (the sodium/carboxyl portion), soap is soluble in water. The long nonpolar tail allows the soap to attach to grease particles and create a micelle, a "bubble" of soap molecules surrounding the grease. The micelles carry away the grease and dirt with them in the rinse water.

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2. MATERIAL AND METHOD

Before start explain the experiment, must describe that, the technique which i used in this experiment:

Reflux & titration

2.1. Reflux

The term reflux is very widely used in industries that utilize large-scale distillation columns and fractionators such as petroleum refineries, petrochemical and chemical plants, and natural gas processing plants.

In that context, reflux refers to the portion of the overhead liquid product from a distillation column or fractionator that is returned to the upper part of the column as shown in the schematic diagram of a typical industrial distillation column. Inside the column, the downflowing reflux liquid provides cooling and condensation of the upflowing vapors thereby increasing the efficacy of the distillation column. The more reflux provided for a given number of theoretical plates, the better is the column's separation of lower boiling materials from higher boiling materials. Conversely, for a given desired separation, the more reflux is provided, the fewer theoretical plates are required.

The equipment of reflux

- Round bottom flask.
- Liebig condenser
- water bath.

Reflux to apply energy to chemical reactions

A liquid reaction mixture is placed in a vessel open only at the top. This vessel is connected to a Liebig condenser, such that any vapours given off are cooled back to liquid, and fall back into the reaction vessel. The vessel is then heated vigorously for the course of the reaction. The purpose is to thermally accelerate the reaction by conducting it at an elevated temperature (i.e. the solvent's boiling point.)

The advantage of this technique is that it can be left for a long period of time without the need to add more solvent or fear of the

reaction vessel boiling dry as any vapour is immediately condensed in the condenser.

In addition, as a given solvent will always boil at a certain temperature, one can be sure that the reaction will proceed at a constant temperature. By careful choice of solvent, one can control the temperature within a very narrow range. The constant boiling action also serves to continuously mix the solution, although a magnetic stirring rod mechanism is often used to achieve a uniform solution. This technique is useful for performing chemical reactions under controlled conditions that require substantial time for completion.



Fig 2.1.1 \ Laboratory reflux apparatus for adding energy to a chemical reaction.

The picture shows a typical reflux apparatus for applying energy to chemical reactions. It includes an optional beaker of water between the reactants and the heat. This is often used as a safety precaution when using flammable reactants and a Bunsen burner in order to keep the flame away from the reactants.

2.2. Titration

Titration is a common laboratory method of quantitative/chemical analysis that can be used to determine the concentration of a known reactant. Because volume measurements play a key role in titration, it is also known as volumetric analysis.

A reagent, called the titrant, of known concentration (a standard solution) and volume is used to react with a solution of the analyte, whose concentration is not known in advance. Using a calibrated burette to add the titrant, it is possible to determine the exact amount that has been consumed when the endpoint is reached.

The endpoint is the point at which the titration is complete, as determined by an indicator. This is ideally the same volume as the equivalence point, the volume of added titrant at which the number of moles of titrant is equal to the number of moles of analyte, or some multiple thereof (as in polyprotic acids). In the classic strong acid-strong base titration, the endpoint of a titration is the point at which the pH of the reactant is just about equal to 7, and often when the solution permanently changes color due to an indicator. There are however many different types of titrations.

Types of titration

There are many types of titrations in common use in the analytical chemistry laboratory. Each type uses a different kind of chemical reaction. Examples of titration types include:

- Acid-base titrations are based on the neutralization reaction between the analyte and an acidic or basic titrant. These most commonly use a pH indicator, a pH meter, or a conductance meter to determine the endpoint.
- Redox titrations are based on an oxidation-reduction reaction between the analyte and titrant. These most commonly use a potentiometer or a redox indicator to determine the endpoint. Frequently either the reactants or the titrant have a colour intense enough that an additional indicator is not needed.
- Complexometric titrations are based on the formation of a complex between the analyte and the titrant. The chelating agent EDTA is very commonly used to titrate metal ions in

solution. These titrations generally require specialized indicators that form weaker complexes with the analyte.

Preparing a sample for titration

In a titration, both titrant and analyte are required to be aqueous, or in a solution form. If the sample is not a liquid or solution, the samples must be dissolved. If the analyte is very concentrated in the sample, it might be useful to dilute the sample.

Although the vast majority of titrations are carried out in aqueous solution, other solvents such as glacial acetic acid or ethanol (in petrochemistry) are used for special purposes.

A measured amount of the sample can be given in the flask and then be dissolved or diluted. The mathematical result of the titration can be calculated directly with the measured amount. Sometimes the sample is dissolved or diluted beforehand, and a measured amount of the solution is used for titration. In this case the dissolving or diluting must be done accurately with a known coefficient because the mathematical result of the titration must be multiplied with this factor.

Equipment

The key equipment used in a titration are:

- Burette
- burette clamp
- support stand
- White Tile – used to see a colour change in the solution
- Pipette
- Erlenmeyer flask

2.3. Determination of saponification number

SAFTY IN THE LABORATORY

- Lab coat
- appropriate eye
- face mask
- gloves

SOLUTION

- 0.5 M KOH /ethanol (analyte solutions)

The molecular Wight of potassium hydroxide = 56.11 g\l

To prepare 0.5 M of it we dissolve 28.5 g in 1 liter of ethanol

- 0.5 M HCl (titrant)

to prepare 0.5 M of HCl

Specific gravity = 1.18 g

Molecular Wight = 36.4 g\mol

V\ V = 37 %

1 ml contains 1.18 g

1000 ml contains 1180 g

1180 x 37 = 436.6 g

83.4 ml in 1000 ml = 1 M

4.1 ml in 1000 ml = 0.5 M

- Phenolphthalein 0.1 M (indicator)

0.2 g dissolve in 20 ml ethanol

- 1\1 ethanol-ether (solvent)

100 ml ethanol + 100 ml ether

- DI Water

The samples

Sample number	Trade market
1	Alwazeer
2	-
3	-
4	RF
5	Baladi
6	RS
7	Halawani
8	Alsawsan
9	-
10	-
11	-

Table 2.3.1 \ The Trademarks of the olive oil samples.

Note: the samples collected by the supervisor Prof.Ameen Rezaq.

Apparatus of the experiment

- Erlenmeyer flasks.
- Liebig condensers.
- Volumetric pipettes.
- Burette.
- Funnel.
- Hot plate.
- Graduated cylinder.
- Stir plate.
- Stir bars.

PROCEDURE

1. Melt the sample if it is not already liquid and filter through filter paper to remove solid impurities and traces of moisture.

NOTE: (Drying oils of high viscosity should not be filtered)

2. Weight 1 gram of sample into an Erlenmyer flask.

3. Pipette 25 mL of 0.5N KOH into the flask.

4. Add 4 ml of the solvent (ethanol-ether)to the flask.
5. Reflux for 30 minutes.
6. Rinse the inside of the condensers with about 25 mL DI water. Allow the Solvent to drain into the Erlenmyer flask.
7. Allow the solution to cool to room temperature.
8. Place a magnetic stir bar in the flask.
9. Add three to five drops of phenolphthalein indicator to the solution with moderate agitation.
10. Add 0.5 HCl (titrant) to the burette, and note level.
11. Add titrant from the burette to the solution until the faint pink color permanently (for at least thirty seconds) disappears.
12. Note the level of titrant in the burette.

3. RESULT

Sample number	" Titrant Volume (TV)"
blank	21.0
1	13.7
2	17.8
3	16.0
4	15.1
5	16.0
6	15.3
7	15.0
8	16.0
9	16.0
10	15.6
11	16.0

Table 3.1 \ Titrant volume required to saponify olive oil sample.

3.1. Calculation

Saponification Value =

$$\frac{(TV_{\text{blank}} - TV_{\text{sample}}) \times (M \text{ of } \text{KoH}) \times (\text{Molecular wight of } \text{KoH})}{\text{Sample Weight (g)}}$$

When sample weight = 1 g

Sample number	Saponification number
1	204.8
2	89.7
3	140.2
4	165.5
5	140.2
6	159.6
7	168.0
8	140.2
9	-
10	151.2
11	140.2

Table 3.1.1 \ The saponification number of olive oil sample.

Note: there was a human error in analysis of sample No.1

4. DISCUSSION

When I compared the range of saponification number of the samples which is (140 – 165) with the normal range of saponification number of olive oil which is (184 – 196), I find it lower.

And this difference is due to the lack of purity of olive oil causes by bad storage for olive oil in the market.

5. REFERENCES

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