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RESEARCH ARTICLE

ASSESSMENT OF THE PHYSICOCHEMICAL PROPERTIES OF SELECTED OILS.

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Abstract

The saponification value (Koettstorfer number), acid value were determined for various oils with a comparative view. As we know oils are major food factor, which is needed for human body.These oils are found in market with different brand names having good quality but some of these branded oils are liable for adultration. Therefore, we have conducted some test to explore some oils quality. From the acid value, the percentage of free fatty acid (FFA) was calculated while from the saponification value give an idea about the amount of NaOHneeded to make sodium salt of soaps.

Introduction:-

Oils and fats are classes of compounds which are one of the main ingredients of our daily diet. They belong to the family of esters. They are triglycerides of higher chain fatty acids. Fats are chiefly triglycerides of saturated fatty acids like lauric acid ($C_{11}H_{23}COOH$), palmitic acid ($C_{15}H_{31}COOH$) and stearic acid ($C_{17}H_{35}COOH$) while the oils are triglycerides of unsaturated fatty acids like oleic acid($C_{17}H_{33}COOH$), linolenic acid($C_{17}H_{29}COOH$) etc. Fats and oils are most abundant lipids in nature. Fats and oil are the principle stored forms of energy in many organism, they insulate body organs and transport fat soluble vitamins through the blood. They are highly reduced compounds and are derivatives of fatty acids. Fatty acids are basically carboxylic acids with hydrocarbon chains of 4 to 36 carbons. They can be saturated or unsaturated. The simplest lipids formulated from fatty acids are Triglycerol or Triglycerides. Triglycerides are composed of three fatty acids each in ester linkage with a single glycerol. Since the polar hydroxyl of glycerol and the polar carboxylate of the fatty acids are bound in ester linkage.

Fats and oils are needed to be saponifiedto get glycerol and salt of the corresponding fatty acid. Saponificationliterally means “soap making”.Saponification value, also known as sap, also called as Koettstorfer Number, is the amount of milligrams of potassium hydroxide required to saponify 1g of fats and oils under conditions specified. Determination of the saponification value (SV)of fats andoils is extremely important for estimating their degreeof averagemolecularweights.It is the index of measurement of average molecular weight of triglycerols.Saponification is the process of breaking down of fats into glycerol and fatty acids salts when treated with alkali.

These fatty acids salts formed during the reaction are termed as ‘soap’. When the alkali potassium hydroxide is used then it forms soft soap whereas when sodium hydroxide used then formation of hard soap occurs. These soaps are used for everyday cleaning, some other metallic soap are used too like lithium soaps for painting purpose and sometimes mixtures of these metallic soaps are also used like mixture of lithium and calcium, known as complex soaps.

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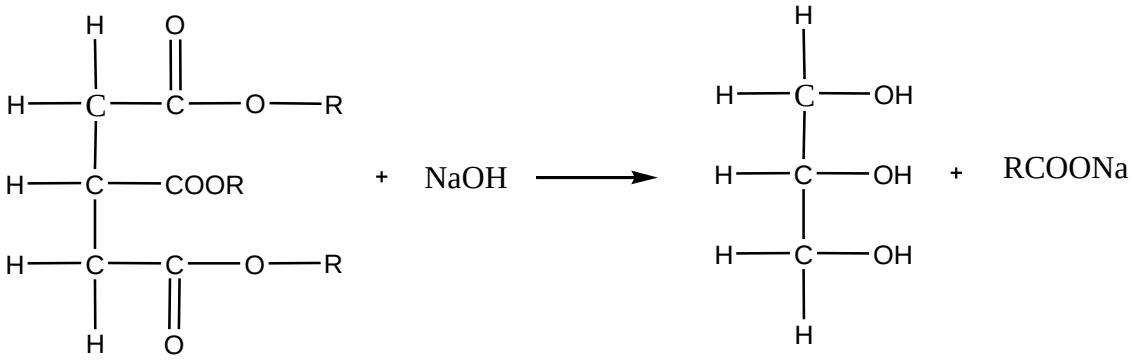
Types of Soaps
The saponification reaction may be tailored to produce two different soaps;

Hard soaps:
1. Hard soaps are made with sodium hydroxide.
2. Hard soaps are good cleansing agent in hard water, containing magnesium, chlorides etc.

Soft soaps:
1. Soft soaps are made with potassium alkali.
2. These soaps are characterized by weaker intermolecular bonds which is easily dissolvable yet not last too long.

Lithium soaps:
1. As the name suggest, it is made of lithium alkali.
2. Sometimes it is used as lubricating grease.
3. Also preferred to form complex soaps like mixture of lithium and potassium.

Reaction for Saponification
The chemical reaction between any fat and alkali is a saponification reaction.



TriglyceridesAlkali Glycerol Fatty acid salt

Mechanism of the above reaction:
1. Nucleophilic attack by the hydroxyl ion
2. Leaving group removal from the triglycerides
3. Deprotonation

This value gives many ideas or facts related to fats and oils. Like, it gives a comparison of average fatty acid chain length of different fats and oils. A low saponification value of long chain fatty acids found in the fats because they have relatively fewer numbers of carboxylic functional groups per unit mass as compared to short chain fatty acids. If more moles of base are required to saponify n grams of fat then there are more moles of the fat and the chain length is relatively small.

Significance
1. The magnitude of saponification value suggests the molecular weight of the fats or oils.
2. Higher the molecular weight, lower will be the saponification value, i.e. saponification value is inversely proportional to the molecular weight of the fats or oils.
3. Saponification value also indicates the length of the carbon chain present in the fats or oils.
4. Higher the saponification value, high is the chance of presence of short chain of fatty acids in the sample of oil or fats.
5. Petroleum oils do not saponify whereas vegetative and animal oils do have a saponification value. This value helps to indicate the presence of vegetative and animal's oils additive in the blended lubricating oils.

Material and Method:-

Saponification value

Reagents required

1.5g Oil sample, 0.5N Ethanolic potassium hydroxide, Phenolphthalein indicator, 0.5N Hydrochloric acid.

Apparatus required

Conical flask, burette, glass beaker (100ml), boiling water bath, condenser

General Procedure:

1. Weigh 1g of fat in a tared beaker and dissolve in about 3ml of the fat solvent [ethanol/ether mixture].
2. Quantitatively transfer the contents of the beaker three times with a further 7ml of the solvent.
3. Add 25ml of 0.5N alcoholic KOH and mix well, attach this to a reflux condenser.
4. Set up another reflux condenser as the blank with all other reagents present except the fat.
5. Place both the flasks in a boiling water bath for 30 minutes.
6. Cool the flasks to room temperature.
7. Now add phenolphthalein indicator to both the flasks and titrate with 0.5N HCl.
8. Note down the endpoint of blank and test.
9. The difference between the blank and test reading gives the number of millilitres of 0.5N KOH required to saponify 1g of fat.

Calculate the saponification value using the formula:

1. Saponification value or number of fat = mg of KOH consumed by 1g of fat.
2. Weight of KOH = Normality of KOH × Equivalent weight volume of KOH
3. Volume of KOH consumed by 1g fat = [Blank – test]ml

Acid value:

Acid value (or neutralization number or acid number or acidity) is the mass of potassium hydroxide (KOH) in milligrams that is required to neutralize one gram of chemical substance.The acid number is a measure of the number of carboxylic acid groups in a chemical compound, such as a fatty acid, or in a mixture of compounds. In a typical procedure, a known amount of sample dissolved in an organic solvent (often isopropanol) and titrated with a solution of potassium hydroxide (KOH) of known concentration using phenolphthalein as a color indicator.

Procedure:

1. About 500 mg of the oil sample is taken in a conical flash and dissolved in 50 mL of distilled alcohol by gentle warming.
2. It is then titrated against 0.1N KOH using phenolphthalein as indicator until a slight pink colour is appeared.
3. Forthistitre value, the acid value is calculated by using the following equation

Acid value A= V x N x 56 / W

Where

V is the volume of alkali added in ml

N is the normality of KOH

W is the weight of the oil sample taken in grams.

56 is the equivalent mass of KOH.

Result:-

Table is a brief summary of various parameters, namely saponification values, acid values determined for various oil samples.For the research purposeand three different oils are taken i.e. coconut oil, mustard oil, olive oil. These three oils have different saponification value and here it will be compared with the standard saponification value. The following table has the calculated saponification value which is done by using the above formula.

Oil	Std. value of Saponification	Obtained Saponification value	Obtained Acid value
Coconut Oil	250-265	252	1.8666

Olive Oil	184-196	194.6	3.7333
Mustard oil	166-175	166.6	3.7333

Conclusion:-

From our analysis, it is found that the saponificaiton values obtained for various oils were within the range of their standard values. It can be very well understood that the coconut oil posseses high saponification value while the low acid values are an indication of lower rancidity of oils.So coconut oil must be used for cooking, hair and for industry.

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