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Determination Of Saponification And Iodine Value Of Sunflower Oil

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Abstract: ***Sunflower oil was used as a source of triacylglycerol analysis. The experiment focuses on the determination of Iodine and Saponification number. Saponification values of oils were determined using the chemical method called saponification method. A standard solution 0.1N potassium dichromate was prepared by weighing about 1-2g of anular crystals accurately in a chemical balance. Iodine number is the number of grams of iodine or iodine compound absorbed by 100gm of oil. It is found that saponification and iodine value of sunflower oil are 144 and 133 respectively. Even though there are different kinds of vegetables, this study is limited to sunflower oil.***

Keywords: Sunflower Oil, Iodine Value and Saponification Value.

I. SUNFLOWER OIL

Sunflower Oil is the non-volatile oil expressed from sunflower (Helianthus annuus) seeds. Sunflower oil is commonly used in food as frying oil, and in cosmetic formulations as an emollient. Sunflower oil has a large collection of benefits to help keep your body healthy and strong. Sunflower oil is a monounsaturated / polyunsaturated mixture of mostly oleic acid - linoleic acid group of oils.

STRUCTURE OF SUNFLOWER OIL

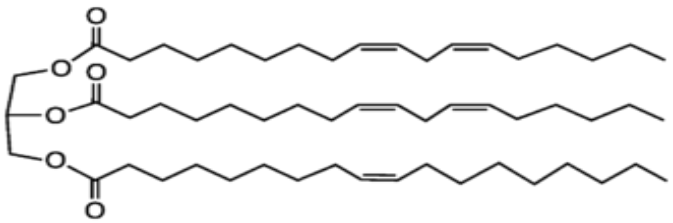

Figure 1: Structure of Sunflower Oil

COMPOSITION OF SUNFLOWER OIL

Sunflower oil contains predominantly linoleic acid in triglyceride form.

- ✓ Palmitic acid: 4.0 per cent to 9.0 per cent,
- ✓ Stearic acid: 1.0 per cent to 7.0 per cent,
- ✓ Oleic acid: 14.0 per cent to 40.0 per cent,
- ✓ Linoleic acid: 48.0 per cent to 74.0 per cent.

Sunflower oil also contains lecithin, tocopherols, carotenoids and waxes. Sunflower oil's properties are typical of a vegetable triglyceride oil. There are several types of sunflower oils produced, some examples are: high linoleic, high oleic and mid oleic. High linoleic sunflower oil typically has at least 69% linoleic acid. High oleic sunflower oil has at least 82% oleic acid. Variations in fatty acid profile in sunflower oil are strongly influenced by both genetics and climate.

II. LITERATURE REVIEW

A theoretical review on the subject matter of study will give the information needed to understand the problem,

theories and methods necessary for evaluating the research problem.

Analytical indices related to fats and oils can be distinguished as structure or quality indices. Structure indices are the iodine value (IV), a measure of total unsaturation of an oil or fat; the saponification value (SV), an indicator of average M.W.; and the hydroxyl value (HV), which is applicable to fatty compounds (or their mixtures) containing (Knothe, 2002).

Saponification is the hydrolysis of fats or oils under basic conditions to afford glycerol and the salt of the corresponding fatty acid (Chalmers and Bathe, 1978). The saponification number is the number of milligrams of potassium hydroxide required to neutralize the fatty acids resulting from the complete hydrolysis of 1g of fat. It gives information concerning the character of the fatty acids of the fat- the longer the carbon chain, the less acid is liberated per gram of fat hydrolysed (Hiemenz and Lodge, 2007).

It is also considered as a measure of the average molecular weight (or chain length) of all the fatty acids present. The long chain fatty acids found in fats have low saponification value because they have a relatively fewer number of carboxylic functional groups per unit mass of the fat and therefore high molecular weight.

One of the classical but still useful parameter used in the characterization of vegetable oils is the iodine value defined as the amount of iodine in grams that react with the double bonds present in 100 g of a given oil sample under specified conditions (Meier, Metzger and Schubert, 2007; Stauffer, 1996; Knothe, 2002). So, this index is a measurement of the number of unsaturations in the aliphatic chain and is hence related to several chemical and physical properties of vegetable oils. According to the average degree of unsaturation measured by their iodine value (often referred to as "siccativity"), sunflower is semi-drying oil if, the iodine value lies between 90 and 130 (Guner, Ya.ci, and Erciyes, 2006; Belgacem and Gandini, 2008).

III. MATERIALS AND METHOD

Sunflower oil was subjected to analysis such as determination of iodine value and saponifcation value.

ESTIMATION OF SAPONIFICATION VALUE

Saponification values of oils were determined using the chemical method called saponification method. About 2.5g of sodium carbonate was weighed out accurately in a chemical balance and transferred in to a 100ml standard measuring flask. Dissolved in water and made up to the mark. About 20ml of this solution was pipette out into clean conical flask and two drops of methyl orange are added to impact a golden yellow colour to the solution. It was titrated against hydrochloric acid taken in the burette. At the end point the solution was pale red orange in colour. From the titre value, the normality of hydrochloric acid was calculated.

Then about 1gm – 2gms of each of oil were weighed accurately in a chemical balance and transferred in to 150ml R-B flask. Then 30ml of alcoholic potash was added from the burette slowly into the flask. It was then fitted with an air condenser and heated on a water bath for about an hour. The flask was cooled and titrated against std. Hcl solution using 1ml phenolphthalein as indicator. At the end, solutions were colourless. Let the titre value i.e., the volume of Hcl required to excess alcoholic potash be V_1.

A blank was done simultaneously with 30ml of alcoholic potash without oil. The flask was cooled and titrated against std. Hcl using phenolphthalein indicator. This titre value i.e., the volume of Hcl for blank titration is V_2.

Using these values the saponification values of oils are determined.

$$\text{Saponification value} = \frac{56.1 \times (V2 - V1) \times \text{strength of Hcl}}{W}$$

Molecular weight of KOH = 56.1
Weight of oil = W

ESTIMATION OF IODINE VALUE

A standard solution 0.1N potassium dichromate was prepared by weighing about 1-2g of anular crystals accurately in a chemical balance. Dissolved in water and made up to 250ml in a standard flask.

20ml of standard $K_2Cr_2O_7$ was pipette out in to a clean 250ml conical flask. Add about 5ml conc. Hcl followed by 10ml of 10% aqueous Kl solution. The liberated iodine was immediately titrated against this solution taken in the burette. When the solution acquires a straw-yellow in colour add 1ml of freshly prepared starch and the titration was continued. All the end point the solution was green (blue to green) in colour. The titration was repeated to get concordant values.

$$Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 2Cr^{3+} + 7H_2O + 3I_2$$
$$2S_2O_3^{2-} + I_2 \longrightarrow 2I^- + S_4O_6^{2-}$$

From the titre value, the normality of thio is calculated.

Then about 0.5gm to 1gm of oil was weighed out accurately in a chemical balance and dissolved in 10ml of carbon tetrachloride in a stoppered 500ml bottle. 25ml of iodine monobromide was added in to the bottle and the time was noted. The resulting mixture was cleared by adding a small addition of known volume of carbon tetrachloride. The bottle was kept aside for about 60 minutes with occasional shaking. The mixture was titrated against std. thio, solution using starch as indicator. At the end point the solution was colourless. Let this titre value ie., the volume of thio for unreacted iodine monobromide be A.

A blank titration was carried out without oil using same quantity of 10ml carbon tetrachloride, also the additional volume used and 25ml of iodine monobromide solution. The mixture was titrated against std. thio solution, using starch as indicator. At the end point the solution was colourless. Let this titre value i.e., the volume thio for blank be B.

Using these values the iodine values of oils were determined.

$$\text{Iodine value} = \frac{(B-A) \times \text{strength of thio solution}}{W}$$

Atomic weight of iodine = 127
Weight of oil = W

IV. RESULTS AND DISCUSSION

SAPONIFICATION VALUE

In the saponification reaction one mole of oil reacts with 3 moles of alcoholic potassium hydroxide and this leads to the formation of glycerol and sodium or potassium salts of fatty acid.

The saponification number of given oil is used for the determination of the size, average molecular weight of the fatty acids and to estimate the non-fatty acid impurities if present. It also gives an idea about the amount of alkali which would be actually required by oil for its conversion into soap. Thus saponification serves for its identification.

OIL	SAPONIFICATION VALUE
Sunflower oil	144

Table 1: Saponification Value of Sunflower Oil

IODINE VALUE

Iodine number is the number of grams of iodine or iodine compound absorbed by 100gm of oil. The double bond present in the unsaturated fatty acid reacts readily with iodine or certain iodine compounds to form an addition compound even while the fatty acid is combined with glycerol in the fat. The iodine number is used to measure of the extent of unsaturation of fatty acid present in oil. There will be variation in each vegetable oil with climate, soil and variety and in each animal fat with nutrition and breed. These variations are small compared to the variation between fats.

OIL	IODINE VALUE
Sunflower oil	133

Table 2: Iodine Value of Sunflower Oil

The determination of iodine value is of great importance in

- ✓ Finding the proportion of adulteration in oils
- ✓ This gives an idea of its drying character.
- ✓ It is a measure of degree of unsaturation of fatty acids present in oil.

V. CONCLUSSION

Vegetable oil is natural oils extracted from plants. In plants they are mostly extracted from seeds. The present work is to predict the iodine value and the saponification value of sunflower. The iodine value of sunflower oil was determined. The high iodine value of sunflower oil indicates the high degree of unsaturated component in sunflower oil. The saponification value of sunflower oil was also determined using the chemical method called saponification method. The high saponification value indicates the presence of low molecular weights fatty acid chain in sunflower oil.

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