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COMPARATIVE STUDY ON THE PHYSICO-CHEMICAL PROPERTIES OF DIFFERENT EDIBLE OILS.

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ABSTRACT :
The importance of ediable oil in industry such as foods, energy, cosmetics, pharmaceuticals, or lubricants has been well documented. Physical properties of vegetable oils depend primarily on composition and temperature. Physico-chemical properties are helps to find the overall quality and adulteration in different oils. In the present study we try to identify physicochemical properties like smoke point, boiling point, density, acid value, saponification value, iodine value, peroxide value of different edible oils. The result found that in all parameters the sesame oil is good for the cooking purposes.
Key words : Vegetable oils, adulteration, Physico-chemical properties, smoke point, boiling point

INTRODUCTION :

The term oil is used in generic sense to describe all substances that are greasy or oily fluid at room temperature . Generally, fats are considered as extracted triglycerides/lipids that are liquid under the same condition. Fats and oils belong to a larger group of naturally occurring substances called lipids. Fats and oils are non-volatile substance insoluble in water but soluble in organic solvent. They constitute along with protein and carbohydrates, the major food stuffs and are widely distributed in nature. Quality can also depend on the type and amount of trace metals present in edible oils.

Different physical and chemical parameters of edible oil were used to monitor the compositional quality of oils. These physicochemical parameters include iodine value (IV), saponification value (SV), viscosity, density and peroxide value (PV) Vegetable oils are considered as an ideal cooking medium due to their health beneficial effects. Although exposure to oxygen, heat, and light enhance the oil deterioration and reduce the nutritional value.

Vegetable fats and oils are substances derived from plants that are composed of triglycerides. Nominally, oils are liquid at room temperature, and fats are solid; a dense brittle fat is called a wax. Although many different parts of plants may yield oil, in actual commercial practice oil is extracted primarily from the seeds of oilseed plants. The physical characteristics of a fat or oil are dependent upon the degree of unsaturation, the length of the carbon chains, the isomeric forms of the fatty acids, molecular configuration, and processing variables .

MATERIAL AND METHOD :

Solubility: Determine solubility of various edible oil like soybean oil, mustard oil, sesame oil, flaxseed oil and coconut oil in 1 ml of the solvent : water, ethanol, chloroform and acetone.

Smoke Point : The smoke point was measured according to the AOCS Method Cc 9a-48. The oil samples were poured into cup and heated up to 40- 50° C/min. The smoke point was determined when the thin and continuous bluish smokes were seen.

Density : Density of different oil were measured by a Relative Density (R.D) bottle with the capacity of 10ml. According to following formula –

$$\text{Density}(\rho) = \frac{\text{Mass of the oil sample } (M)}{\text{Volume of the R,D bottle } (V)} \quad \text{g/ml}$$

Boiling point measurement : The boiling point of oil samples were measured by a thermometer ±1 C. The boiling point depends upon the degree of unsaturation of fatty acids.

Acid value: Free fatty acids value of interesterified products was determined by AOCS (1989) method. Take 1 gms of well mixed and entirely liquid oil in a 250 ml conical flask. Added specified quantity of neutralized ethanol (5 ml) in it. Added 2-3 drops of phenolphthalein (1%) indicator. Titrate it against 0.1 N KOH solution shaking vigorously to the appearance of first permanent pink color end point. Free fatty acid value was calculated as below.

Acid value = N × Mol. Wt (56) × (Vol. of KOH)/ Wt. of sample in gm

Saponification value measurement: The saponification value is determined by taking 2-3 gm of oil sample in a RB to which is added 25 mL
0.5 M KOH and heated under a reserved condenser for 30–40 min to ensure that the sample was fully dissolved. After this sample was cooled, phenolphthalein was added and titrated with 0.5 M of HCl until a pink endpoint was reached. A blank was determined with the same time conditions.
S.V = (B-S)×N×56.1/W
B=Blank sample, S=Oil sample
N=Normality of HCL, W=Weight of oil sample

1.1 Iodine value (IV) measurement : A known weight of the oil sample is treated with an excess of iodobromine (IBr) in glacial acetic acid. Unreacted iodobromine is reacted with potassium iodide which converts it to iodine. The iodine concentration is then determined by titration with standard sodium thiosulphate.
IV = (V1-V2)ml×N×0.12691×100÷W
Where, V1 is the quantity of sodium thiosulphat used for blank, V2 is the quantity of thiosulphate for sample, N is the normality of thiosulphate solution, W is the wt of the oil sample and 126.9 is the molecular weight of iodine.
Peroxide value (PV) Measurement : Peroxide value is a measure of peroxides contained in the oil. PV is determined by measuring iodine released from potassium iodide. A known measured weight of oil samples is dissolved in acetic acid then chloroform and saturated KI mixture are added to the sample and the amount of iodine liberated from KI by the oxidative action of peroxides present in the oil is determined by titration with standard sodium thiosulphate using starch solution as an indicator. Titration was also performed for blanks.
PV(meq/kg oil) = (S – B) × W × N
where B is the volume of sodium thiosulphate used for blank, W is the weight of sample, S is the volume of sodium thiosulphate consumed by the sample oil and N is the normality of standard sodium thiosulphate.

Adulteration in oil sample:
Detection of other oil in different oil samples:
Detection of adulteration of oil determine by taking 1 ml oil in a test tube. Treated with 4 ml of distilled water in the test tube ensure that the sample was fully dissolved. After this take 2 ml of mixture in another test tube and Add 2 ml of conc. HCL to the mixture and observe the colour of the sample change in colour of the sample detect there is an adulteration in the oil sample and no colour change is observe this is an un adulteration in oil sample.

Sesame oil **Mustard oil** **Coconut oil** **Flaxseed oil** **Soybean oil**

Result : No colour change in any of the oil sample there is an un adulteration in all oil samples.[FSSIA]

2. RESULT AND DISCUSSION :

Following different physico-chemical parameters were tested for monitoring quality of edible Oil.

2.1 Solubity:

Sr.No	Water	Ethanol	Chloroform	Acetone
1. Soybean	Insoluble	Soluble	Soluble	Soluble
2. Mustard	Insoluble	Soluble	Soluble	Soluble
3. Flaxseed	Insoluble	Soluble	Soluble	Soluble
4. Coconut	Insoluble	Soluble	Soluble	Soluble
5. Sesame	Insoluble	Soluble	Soluble	Soluble

Table 1. Solubility of edible oils

2.2 Smoke point and Boiling point:

Smoke point is an indicator of thermal stability and it is the beginning of both flavor and nutritional degradation. It is the temperature at which the sample begins to smoke under specified conditions. Heating produces free fatty acid from oils and as the time of heating increases, more free fatty acids will be released, thereby decreases the smoke point of the oil.

The boiling point of an oil is also called the f**lash point of cooking oil,** is the temperature at which the vapor pressure of Cooking oils have different boiling points, which can affect the cooking process and the resulting food. Understanding the boiling points of cooking oils is essential for achieving the desired results in cooking and for maintaining the quality of the oil. oil equals the pressure around the liquid, and the liquid gets converted to vapor.

Oil types	Smoke point in ℃	Boiling point in ℃
1.Soybean oil	232℃	178℃
2.Mustard oil	249℃	170℃
3.Flaxseed oil	106℃	343℃
4.Coconut oil	176℃	158℃
5.Sesame oil	210℃	189℃

Table 2. Smoke point and Boiling point of edible oil

2.3 Density: Oils with the density of lower values are highly appreciable to consumers. The results tabulated in Table 3 show that at room temperature of 34°C highest and lowest values of the densities are 2.04 g/ml and 2.00 g/ml for sesame oil, and mustard oil respectively.

2.4 Acid value:

Acid value of oils indicates the amount of free fatty acid present in the oil. It determines the purity of oils. The higher the values, the lower the possibility of the oils to be used as cooking purpose. In table no. 3 it was observed that heigher and lower acid values obtain from Mustard oil 2.24 and sesame oil 1.12, respectively. Higher values indicates that triglycerides of oil are converted into fatty acids and glycerol which cause rancidity of the oil.

2.5 Saponification value of oil:

Saponification value is a rough index of the molecular weight of the fat or oil. The smaller the saponification value the higher the molecular weight. It also indicates the quantity of alkali required for conservation of a definite amount of fat or oil into soap. It is used to check the adulteration of fat and oils. The Saponification value obtained for the oil samples in folllowing Table no.3 showed that 250 mg KOH/g for coconut oil and 171.10 mg KOH/g for mustard oil as highest and lowest value, respectively.

2.6 Iodine value of oil:

Iodine value is a measure of the degree of unsaturation or double bonds among the fatty acid present in the oil therefore it does not tell precisely the fatty acids composition of any oil. Iodine value or number is useful as a guide to check adulteration of oil and also as a process control of oil. It was observed in table no.3 that higher and lower iodine values obtained for Flaxseed oil and coconut oil were 19 0 g and 7. 48 g, respectively.

2.7 Peroxide value of oil:

Peroxide value (PV) is used as a measure of the extent to which rancidity reactions have occurred during storage it could be used as an indication of the quality and stability of fats and oils. The peroxide value was also found to increase with the storage time, temperature and contact with air of the oil samples. In the study, in given table no,3 soybean oils and sesame oil showed the lower peroxide values in the range of 1-3 meq/kg oil which indicates a relatively good quality of these oils. On the other hand, mustard oils, coconut oil, showed higher the values in the range of 5-13 meq/kg oil.

Table 3. Physicochemical properties of different edible oil

Name of oil	Acid Value (mg KOH/g)	Sap. value (mg KOH/g)	Iodine value (g I_2/100 g oil)	Peroxide value (meq /kg)	Density (g/ml)
Soybean oil	1.68	172	140	2.7	2.03
Mustard oil	2.24	171.10	105	8.78	2.00
Sesame oil	1.12	190.74	112	1.24	2.04
Flaxseed oil	1.68	187.93	190	5.15	2.03
Coconut oil	1.68	250	7.48	8.61	2.03

CONCLUSION:

In the present study, various physicochemical parameters have been examined for five edible oil samples. Regarding physicochemical characteristics, five samples do not exactly demonstrate all parameters have recommended values however some of them shows acceptable values.

The study shows that the acid values and peroxide value lower ones with low free fatty acid content and the peroxide value was found to increase with the storage time, temperature and contact with air of the oil samples which are good quality of attributes of ideal edible oils. When Iodine value is high the degree of unsaturation is present in the oil and when higher in saponification value lower the fatty acid average length, which give better quality to the edible oil.

Acid value: In the given table no.3 Mustard oil showed high acid value 2.24 mgKOH/g and sesame oil showed very low acid value 1.12 mgKOH/g as compare to other oil, therefore sesame oil is good for the cooking purpose.

Saponification value: In the given table no. 3 Mustard oil contain low SV 171.10 mg/OH/g and Coconut oil contain high SV 250 mgKOH/g as compare to other oils, which is good for cooking purpose.

Iodine value : In the given table no.3 coconut oil have low IV 7.48 gI_2/100g and faxseed oil have more IV 190 g I_2/100g than other oils which is preferable for the cooking.

Peroxide value: In the given table no.3 mustard oil showed high PV 8.78 meq/kg and on the other hand sesame oil showed reativily low PV 1.24 meq/kg which is good for cooking purpose.

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