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Evaluation of Physicochemical properties of some Edible oils available in Gondia

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ABSTRACT

Edible oils are vital constituent of our daily diet which provide energy essential fatty acids, and serve as carrier of fat soluble vitamins. Edible oils from plant, animal, or synthetic origin, are used in frying, baking, and other forms of cooking, and in salad dressings and bread dips. Plant- derived edible oils consist of carboxylic acids with long hydrocarbon chains, in contrast to petroleum-based oils which lack the carboxyl group on the end. In the present paper an attempt has been made to evaluate the physicochemical properties(density, moisture content, specific gravity, refractive index, boiling point, viscosity, acid value, peroxide value, iodine value, saponifiation value) of some available edible oils in Gondia and detail description of various factors affecting edible oils like temperature, moisture, oxygen, effect of refining process, types of adulterations, effects of metals, and antioxidant properties of oils has been discussed. The result of the present study will help the oil producing industry to find out the most economically viable oil blends for cooking purposes, with maximum nutrition as well as desirable physico-chemical properties.

1. Introduction

Edible oils had made an important contribution to the diet of people in many countries serving as a good source of protein, lipid, and fatty acids for human nutrition including the repair of worn out tissues and new cells formation as well as a useful source of energy [1]. Edible oils are very important food for the world. The human body uses oils and fats in the diet for three purposes, such as being and energy source, being a structural component, and making powerful biological regulators. Oils and fats also play an important role in metabolic reactions in the human body [2].

The physical value of oil depends upon its chemical composition; even today these values play a vital role while using different oil for industrial product [3-4]. These include carbohydrates, lipids, proteins, vitamins, minerals, some organic acids and purines [5]. The food value of the edible lipids also depends on chemical properties like iodine value, peroxide value, acid value, saponicfication value etc, as well as on some physical properties like solidification temperature, colour, appearance etc. [6].

Several factors affect the edible oil quality such as agronomic techniques, seasonal conditions, sanitary state of drupes, ripening stage, harvesting and carriage systems, method and duration of storage, and processing technology. The major factors affecting edible oil quality are temperature, moisture, sunlight, soil fertility, and nutrients. It is possible to determine by different analytical techniques how to assess the quality of edible oil and to avoid possible adulterations [7].

The aim of this paper, which is part of a wider research programme concerning the possibility to develop systems for the use of vegetable oils as a source of fuel, is to improve the understanding of the physical and chemical properties of vegetable oils and to define the possible relationships between them. A thorough understanding of this type of information will allow a more detailed definition of the performance of this product in diesel engines and, in general, in the conversion systems used for energy recovery.

2. Materials and Methods

2.1 Materials

All the chemicals and reagents were used in this work was of analytical grade and supplied by SD fine and Loba chemical company. The solution of the reagents (0.1N NaOH, 0.1N HCl, 0.5N NaOH, 0.1N Na2S2O3) were prepared by using distilled water. All the glasswares used were supplied by Borosil. The glasswares were calibrated properly before takingreading.

2.2 Methods:

Physiochemical parameter:

1) Saponificationvalue
2) Acidvalue
3) Freefatty
4) Peroxidevalue
5) Iodinevalue
6) EsterValue
7) SpecificGravity
8) Refractiveindex
9) Viscosity andDensity
10) Odour
11) Colour
12) Stability

2.2.1. Saponification value

Exactly 1.0g of the oil sample has been dissolved in 3.00 ml of ethyl alcohol in a 50 ml conical flask. Then 25ml of 1% phenolphthalein has been added and the solution has been titrated to a colorless end point with 0.5M HCl. A blank titration has been run in all respect. Saponification is the hydrolysis of fats or oils under basic conditions to afford glycerol and the salt of the corresponding fatty acid. Saponification literally means "soap making".

The saponification value was estimated using the following equation:

$$\text{Safonification value} = \frac{56.1 \times (b-a) \times N}{W}$$

where$W$is weight of sample that equals 2 grams, $b$is blank titre value, $a$is sample titre value, and $N$is 0.5 normality of HCl[8].

It is important to the industrial user to know the amount of free fatty acid present, since this determines in large measure the refining loss. The amount of free fatty acid is estimated by determining the quantity of alkali that must be added to the fat to render it neutral. This is done by warming a known amount of the fat with strong aqueous caustic soda solution, which converts the free fatty acid into soap. This soap is then removed and the amount of fat remaining is then determined. The loss is estimated by subtracting this amount from the amount of fat originally taken for the test.

2.2. 2. Acid value

0.1M KOH solution has been standardized using 0.1M oxalic acid solution. The solvent mixture has been neutralized with standard 0.1M KOH solution until persistent faint pink colour appeared. Then 1.25g of the oil has been transferred into a 250ml conical flask and 125ml of the solvent mixture was added to the sample. This has been dissolved by agitation and warming on a steam bath. At this point the pink colour disappeared and a clear solution has been obtained. The solution has been titrated against the 0.1M KOH solution. The end point has been obtained by the restoration of the pink colour. Same procedure has been repeated thrice and the average end point obtained.

The acid value was estimated using the following equation:

$$\text{Acid value} = \frac{2.82 \times V \times 100}{W \times 1000 \times 4}$$

where$W$is weight of oil that equals 3 grams, $V$is titre value of 1N NaOH, and 2.82 is equivalent weight of oleic acid [9].

2.2.3. Free fatty.

To 20ml of ethanol, diethyl ether (1:1 v/v) mixture, 2ml of 1% phenolphthalein solution has been added and the mixture was neutralized using0.10M NaOH solution. Then 5g of each oil sample has been added to the neutralized mixture and titrate against 0.1M NaOH solution with constant shaking until a pink colour developed and persisted for 15 minutes. The titer values have been used to obtain the free fatty acid value.

2.2.4. Peroxide value:

Exactly 1.0g of KI and 20ml of solvent mixture (glacial acetic acid: chloroform, 2:1 v/v) have been added to 1.0g of the oil sample and the mixture has been boiled for one minute. The hot solution has been poured into a flask containing 20ml of 5% KIO3solution. Few drops of starch solution have been added to the mixture and the latter has been titratedwith 0.025M sodium thiosulfate solution.

The peroxide value was estimated using the following equation:

$$\text{Peroxide value} = \frac{V \times N \times 100}{W}$$

where$V$is volume of sodium thiosulphate, $N$is normality used for titre, and$W$is weight of the sample [10].

2.2.5. Iodine value

Place a quantity of the test substance, accurately weighed, as specified in the monograph, in a dry 300-mL to 500-mL stoppered flask, add 15 mL of carbon tetrachloride R and dissolve. Add 25 mL of iodine bromide TS, insert the stopper, previously moistened with potassium iodide (80 g/l) TS, shake the flask gently, and keep in the dark for 30 minutes, unless otherwise specified in the monograph. Add 20 mL of potassium iodide (80 g/l) TS and 150 mL of water, and, whilst shaking the contents of the flask, titrate with sodium thiosulfate (0.1 mol/l) VS, adding starch TS as indicator towards the end of the titration. Note the number of mL required (a). At the same time carry out the operation in exactly the same manner, but without the substance being tested, and note the number of mL of sodium thiosulfate (0.1 mol/l) VS required(b).

The iodine value was estimated using the following formula:

$$\text{Iodine value} = \frac{(b-a) \times N \times 1.269 \times 100}{W}$$

where$b$is blank titre value, $a$is sample titre value, $N$is normality of thiosulphate, and $W$is weight of sample [11].

2.2.6. Ester Value

Place 1.5 g to 2 g of the substance in a tared, 250 mL flasks, add 20 mL to 30 mL of neutralized alcohol and shake. Add 1 mL of phenolphthalein, and titrate with 0.5 N alcoholic potassium hydroxide until the free acid is neutralized. Add 25.0 mL of 0.5N alcoholic potassium hydroxide. Heat the flask on a steam bath, under a suitable condenser to maintain reflux for 30 minutes, frequently rotating the contents titrate the excess potassium hydroxide with 0.5 N hydrochloric acid. Perform a blank determination under the same conditions.

2.2.7. Specific Gravity

Specific gravity of oil is determined as the ratio of the density of oil in to the density of water at same temperature.

$$\text{Specific gravity} = \frac{\text{Density of oil}}{\text{Density of water}}$$

2.2.8. Refractive index

The refractive indices, $\eta 40\ D$, (RI), of the oils and fat samples were measured using the Abbe refractometer connected to a thermostatically controlled water bath that maintained the

temperature of the refractometer at 40 ± 0.1ºC. The determination of refractive indices was done following the procedures of Cocks and van Rede (1997).

2.2.9. Viscosity and Density

The density of the oils was determined by a mass over volume measurement. The viscosity of the oils and their blends was determined by BROOKFEILD DVII + Pro viscometer at a constant shear rate at constant temperatures which were controlled by a microprocessor assisted water bath using spindle S51.

3. Results &Discussion

Physicochemical properties of some Edible oils mention given table number 01

Table Number 01 Physicochemical properties of some Edible oils

Physicochemical properties	Palm Kernel Oil	Coconut Oil	Groundnut Oil	Corn Oil	Mustard Oil	Sunflower Oil	Peanut Oil
Saponification value	270.5 ± 54.1	261.5 ± 48.6	184.4 ± 98.2	165.5 ±54.1	130.8±23.9	178.6 ±66.9	---
Acid value	2.8 ±0.2	3.7 ± 0.4	6.7 ±0.6	---	---	0.889	---
Free fatty	1.38 ± 0.16	2.46±1.3	4.9 ± 0.36	0.165	---	0.052	0.164
Peroxide value	13.8 ±0.7	---	---	0.184	0.56	6.347	2.100
Iodine value	14.87±5.04	14.±56	9.5±46	14.59	9.94	10.23	---
Specific Gravity value	0.842	0.98±0.0065	0.94±466	---	---	0.979	0.2365
Refractive index	1.514^{o}	134.1 ± 146	1.47±0.001	1.4750	---	---	1.654
Viscosity	--	---	---	136 (millipose)	126.56 (millipose)	146.56 (millipose)	146.23 (millipose)
Odour	Burnt Smell	Pleasant	Pleasant	---	---	---	---
Colour	Burnt Brown	Pale Yellow	Very Pale Yellow	25(R) 0.9 (Y)	---	25(R) 0.4 (Y)	1.3(R) 10 (Y)
Stability	Soluble in non- polar solvent	Soluble in non-polar solvent	Soluble in non-polar solvent	---	---	---	---
Ester Value	267.8 ± 54.4	232 ± 8.5	197.5 ±	---	---	187± 789	---

4. Conclusion

Scientific information and knowledge on less familiar or under-utilized oils encourage the utilization of both nutritional and industrial potential. The result of physico-chemical properties further confirmed the quality of the extracted oil for cooking and industrial potentials. The physical, chemical, and functional properties of groundnut that relate to specific end products have to be determined and refined to facilitate screening breeding material for such properties. Also, methods have to be developed so that hulls and other by-products can be better utilized.

So, this study will help the oil producing industry to find the most economically viable oil blends for cooking purposes, with maximum nutrition as well as desirable physic-chemical properties. As India is the second largest producer of vegetable oils, blending of traditional oils with this nonconventional oil is a good choice by which we can manufacture edible oils of good characteristics and ensure their quality. The food value of the oils and blends can also be predetermined to provide the safest food for consumers.

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