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Research Article

STUDY ON PHYSICO-CHEMICAL CHARECTERIZATION OF EDIBLE OILS FROM AGENCIES OF BULDHANA DISTRICT

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ABSTRACT

Fats and oils are nutritionally important because they form one of the three major classes of food. Oils are used in a variety of ways. They are used for food texturing, baking and frying and also used industrially, in the manufacture of soap, detergent, cosmetics and oil paints. It is therefore, physico chemical properties like density, acid value saponification value peroxide value ester value and free fatty acids of different oil samples like groundnut, soya bean, coconut, seasum oils from various oil treading companies have been carried out. The ranges of following values were obtained for the various parameters measured. For all oils, saponification value 175 to 251mgKOH/g, Acid value 0.56 to1.12mgKOH/g 185 to 252 and %FFA 0.282 to 0.56 were obtained. The objective was to justify their utility for cooking purposes.

Keywords: Physico-chemical properties, Acid value, free fatty acids, Saponification value.

INTRODUCTION

The sources of triglycerides are vegetable fats and oils which are of plant origin. Generally oils are liquid and fats are solid at room temperature; a dense brittle fat is called a wax. Basically oils and fats are similar in composition. Chemically the difference between oil and a fat is that oilsare usually triglycerides of unsaturated fatty acids and fats are triglycerides of saturated fatty acids[3,5,7,8,11].

The quality of fats and oils can be tested by using physical and chemical parameters such as specific gravity, refractive index, viscosity, iodine value, saponification value, peroxide value, acid value, titer, melting point, cloud point, flash point, smoke point and volatility)[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[6,9]. However, fats become rancid and develop an unpleasant odor and taste when kept over long period of time. Fats and oils are soluble in non polar solvents such as benzene, acetone, ether etc. and insoluble in polar solvent such as water[13, 14].

In the recent past physico-chemical characterizations of vegetable oils and fats have been carried out by many co-workers [1, 4,10,12].

In this context it is intended to study the properties of some of the oil samples collected from oil venders through the physico-chemical tests like (specific gravity, acid value, peroxide value, percentage of free fatty acid, saponification value) in Buldhana district.

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 $Na_2S_2O_3$) were prepared by using distilled water. All the glasswares used were supplied by Borosil. The glasswares were calibrated properly before taking reading.

METHODS

1. Determination of specific gravity of an oil sample

Specific gravity of the oil sample has been determined by weighing the *25 ml* empty specific gravity bottle. Weight of oil sample has been calculated by weighing the oil sample in specific gravity bottle and cancelling the weight of empty gravity bottle from the weight of gravity bottle containing oil sample.

2. Determination of 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.

3. Determination of 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.

4. Determination of 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% KIO_3solution. Few drops of starch solution have been added to the mixture and the latter has been titratedwith 0.025M sodium thiosulfate solution.

5. Determination of the Free Fatty Acids of the Oil Samples

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.

RESULT AND DISCUSSION

1. Measurement of Physico-chemical Tests Part A

Measurements of Physico-chemical Tests like density, acid value, colour etc. have been carried out by usual methods which have been discussed in chapter 3. Density of oil is not the important parameter for technologists as far as the quality of oil is concern, but it is very important in the trading of oils since shipments are sold on a weight basis but measured on a volume basis .The values of specific gravities of oils have been incorporated in Table 1 shows different values of Specific gravities that may bedue to the different fatty acids composition and solid contents.

Acid value (AV) is an important indicator ofvegetable oil quality. AV is the number of milligrams of KOH (in milligrams) required to neutralize freefatty acids present in 1.0 g of oil sample. But the free fatty acid (%FFA) content is a conventional expression of the percentage mass-fraction of total fat. According to the nature of the fat it is expressed as lauric acid for coconut, palm kernel, and similar oils, as palmitic acid for palm oil and as oleic acid for all other oils. In the view of the results shown in Table 1, all the samples have acceptable AV and %FFA values.

Table I: Physico-chemical Measurements of Oil samples from different parts of Buldhana District: Part A

S. no	Agency	Oil	Colour	Sp. Gravity Gm/cc	Acid Value
1.	G.S.C, Malkapur	Groundnut oil	Yellowish Clear transparent	0.85	0.561
2.	AMI Oil,Khamgaon	Refined Soya bean Oil	Yellowish Clear transparent	0.78	0.561
3.	S. O. A., Buldhana	Soya bean Oil	Light yellow	0.83	0.561
4.	M.A.Mehkar	Sesame Oil	Dark yellow	0.87	0.561
5.	S.A Malkapur	Cotton seed Oil	Golden yellow	0.83	0.561
6.	Ambika Agency, Lonar.	Coconut Oil	Colourless	0.75	1.12
7.	Ambuja, Gujarat	Soya bean Oil	Light yellow	0.84	0.56
8.	G.A Chickli, Buldana	Soya bean Oil	Light yellow	0.85	0.561
9.	S.A ,Nandura.	Groundnut Oil	Yellowish	0.86	0.561
10.	S.A., Chikhali	Groundnut Oil	Yellowish	0.86	0.561

It has been observed that the colour of the oils is yellowish and fairely transparent indicating the verginity of oil. The transparent yellow colours of the oils also reveals that there has been no enzymatic degradation of oil taken place.

Acid values of 0.6 and 4.0 have been recommended by each of FDA/WHO to be the upper limit for refined and virgin oil sample. The acid values of the oil samples have been incorporated in Table I. None of the investigated oil samples were exceeded the upper limit of 2.0 set for virgin oil sample. High acidity of coconut oil sample may be due to the enzymatic reactions. Low acid values of oils indicating the resistance to rancidity. The acid values also revels the resistance of oil to gum formation and corrosion and these can be stored for a longer time.

2. Measurement of Pysico-chemical Tests Part B

The physico-chemical characteristics of oil samples like saponification value, peroxide value, percentage free fatty acids, ester value etc. from different parts of Buldhana district have been studied extensively. The results have been incorporated in Table II.

The higher saponification numbers of the oil indicates higher solubility of Soap that can be made from it. The lower value of saponification value in the oil suggest that the mean molecular weight of fatty acids is lower than that of other vegetable oil or that the number of ester bonds is less when compared to that of other vegetable oil with the increase in the temperature, saponification value for the various oil samples decreases indicating easy soap formation at higher temperature. The saponification values of different oil samples have been incorporated in Table II.

The peroxide value of oil is important property for the measurement of extent to which rancidity is produced due to autoxidation reactions occurred during storage of the oil. The peroxide values have been presented in Table II indicating the oxidation of oil samples in its early stages.

Production of fatty acid and glycerol from oils are important in the quality control of the vegetable oils indicating the extent of hydrolysis of triglycerides, which havebeen studied by determining percentage free fatty acids. The percentage free fatty acids (FFA) which attributed due to the hydrolysis of oil have been included in Table II.

Ester value is number of milligrams of potassium hydroxide required to hydrolyze the esters present in one gram of oil sample. This is the difference between saponification value and acid value. High ester value indicates the presence of high amount of ester and low molecular weight fatty acid content. The ester values have been included in Table II.

Table II: Physico-chemical Measurements of Oil samples from different parts of Buldhana District: Part B

S. no	Agency	Oil	Saponification value	Ester value	Peroxide value	% FFA
1.	G.S C, Malkapur	Ground nut oil	185	184.439	2	0.564
2.	AMI Khamgaon	Refined Soyabean Oil	205.2	204.639	6	0.282
3.	S.O.A, Buldhana	Soya bean Oil	190.5	189.939	1.06	0.282
4.	M A, Mehkar	Sesame Oil	189.2	188.639	0.04	0.282
5.	S.A. Malkapur	Cotton seed Oil	175.6	175.039	1.12	0.282
6.	A.A., Lonar.	Coconut Oil	170.3	169.18	8.1	0.564
7.	A.G.	Soya bean Oil	225.2	224.64	1.06	0.282
8.	G.A. Chickli, Buldana	Soya bean Oil	220.6	219.75	1.06	0.282
9.	S.A.,Nandura.	Groundnut Oil	212.32	211.759	2	-------
10.	S.A., Chikli	Groundnut Oil	252.2	251.639	2	0.282

The lower value of saponification value in the oil suggests that the mean molecular weight of fatty acids islower than that of other vegetable oils. It has been observed that the saponification value of coconut oil was lowest indicating the short chain unsaturated fatty acids.

The High peroxide values of soybean oil from AMI Khamgaon and coconut oil from A.A. Lonar indicates the slight high percentage of rancidity this may be due to the action of lypase exists due to the soil contamination.

It has been observed that the free fatty acid percentage in case of groundnut oil supplied by G.S.A. Malkapur is slightly higher which indicate the high degree of hydrolysis of oil.

The High ester values of oils from different agencies indicating the presence of high amount of ester and low molecular weight fatty acid content.

CONCLUSION

The physico-chemical characteristics of oil samples like specific gravity, Acid value, saponification value, peroxide value, percentage free fatty acids, ester value etc. from different parts of Buldhana district have been studied extensively.

Acid values of 0.6 and 4.0 have been recommended by each of FDA/WHO to be theupper limit for refined and virgin oil sample. None of the investigated oilsamples were exceeded the upper limit of 2.0 set for virgin oil sample. High acidity of coconut oil sample may be due to the enzymatic reactions. Low acid values of oils indicating the resistance to rancidity. The acid values also revels the resistance of oil to gum formation and corrosion and these can be stored for a longer time.

The lower value of saponification value in the oil suggest that the mean molecular weight of fatty acids islower than that of other vegetable oils. It has been observed that the saponification value of coconut oil was lowest indicating the short chain unsaturated fatty acids.

The High peroxide values of soya been oil from AMI Khamgaon and coconut oil from A.A. Lonar indicates the slight high percentage of rancidity this may be due to the action of lipase exist due to the soil contamination.

It has been observed that the free fatty acid percentage in case of groundnut oil supplied by G.S.A. Malkapur is slightly higher which indicate the high degree of hydrolysis of oil.

The High ester values of oils from different agencies indicating the presence of high amount of ester and low molecular weight fatty acid content.

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REFERENCES

1. Abdelmonem M Abdellah, Khogali El Nour Ahmed Ishag and Hager M Omer. Assessing the Sudanese Standards and Guidelines of Edible Oils: A Case Study of Sunflower Oil. American-Eurasian J Agric and Environ Sci. 2012;12(5):682-688.
2. Ali MF, El Aii BM and Speight JG. Handbook of Industrial Chemistry, McGraw-Hill Companies. 2005;96.
3. Eddy NO and Ekop AS. Effect of additive on some physical parameters of palm oil. E-Journal of Chemistry. 2007;4:351-355.
4. Fakhri NA and Qadir HK. Studies on Various Physico-Chemical Characteristics of Some Vegetable Oils. Journal of Environmental Science and Engineering. 2011;5:844-849.
5. Hamed SF. Edible oil as an alternate solvent forextraction of antioxidant components from natural herbs. Journal of Applied Sciences Research. 2006;2:567-569.
6. Javed MA. Studies on composition and metabolism oflipids in seeds of citrullus species, Ph. D. Thesis, University of the Punjab, Lahor-Pakistan. 1994.
7. Lehninger AL, Nelson DL and Cox MM. Principles of Biochemistry. 2008;5:343-346.WH Freeman publishers, New York.
8. O'Brien RD. Fats and Oils, 3rd ed., CRC Press, Taylor & Francis Group. 2009;2-52.
9. Otunola GA, Adebayo GB and Olufem OG. Evaluation of some physicochemical parameters of selected brands of vegetable oils sold in Ilorin metropolis. International J of physical Sciences. 2009;4:327-330.
10. Pandurangan MK, Murugesan S and Gajivaradhan P. Physico-chemical properties of groundnut oil and their blends with other vegetable oils. Journal of Chemical and Pharmaceutical Research. 2014;6(8): 60-66.
11. Pérez Camino MC, Moreda W and Cer A. Determination of diacylglycerol isomers in vegetable oils by solid-phase extraction followed by gas chromatography on a polar phase,

Journal of Chromatography. 1996A;721:305-307.
12. Sarma PVVR, Sailaja BBV, SreenivasaRao TA and NageswaraRao G. Physico chemical studies on texturized and partially hydrogenatedRBD palm oil samples. Scholars Research Library Annals of Biological Research. 2011;2(4):439-446.
13. Tasic DR and Klofutar C. Characteristics of vegetable oilsof some Slovene manufacturers. Acta Chim Slov. 1999;46:511-512.
14. Umar Garba M, Alhassan M and Kovo AS. A review of advances and quality assessment of biofuels leonardo, Journal of Sciences. 2006;9:167-168.