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Compositional studies on oils and fats

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Abstract

India is one of the largest producers of oil seeds in the world. Comparative study of composition and physio-chemical properties of Soya bean oil, Rice Bran oil, Karanj seed oil, Mahua seed oil, Orange seed oil was carried out. Results showed that Mahua seed oil has highest Acid value of 3.1 (mg/KOH) and rice bran oil has lowest that is 1.3 (mg/KOH). In GLC Palmitic acid content of Karanj seed oil is highest. Stearic acid content of Mahua seed oil is high. Linoleic acid content of Rice bran oil is high and Linolenic acid content of Orange seed oil is highest.

Keywords: Soya bean oil, Rice bran oil, Karanj seed oil, Mahua seed oil, Orange seed oil, Acid value, GLC

Introduction

India is one of the largest producers of oilseeds in world. Annual production and consumption of oils and fats is about 119 million tonnes and rising steadily at a rate of 2-6 million tones per year. In India 70 percent area of total oilseed crops is covered by soya bean. Among non conventional oils rice bran oil, Mahua seed oil, Karanj seed oil and orange seed oil are the most important. The environmental conditions are good for growth of oilseeds so in India large no of oilseed processing plants are present.

Soyabean is dominant oilseed produced in the world, due to its favorable agro economic characteristics, its high quality protein and its valuable edible oil. The rice bran is the by-product of rice milling and bran layer contains 18-22 percent oil. The rice bran oil is having high medicinal value and therapeutical applications. The oryzanol present in rice bran oil is effective for lowering blood cholesterol. Rice bran oil also acts as anticancer and anti-infection agent in humans.

Karanj seed oil is used for healing, antiseptic and homeostatic effect by ayurvedic practitioners. It also used for skin diseases and rheumatic part. The Mahua seed oil is edible and also used as a laxative for treating habitual constipation, piles and haemorrhoids and also as emetic. The orange seed has therapeutic properties are antiseptic, anti depressant, antispasmodic, anti-inflammatory, carminative and tonic.

This section includes the following activities

- Study of different oils produced in India like conventional as well as non conventional oils. The study is focused on the total area of cultivation, annual production, oil extraction plants, per capita consumption and environmental conditions.
- Soyabean oil: The area of cultivation is determined and total annual production with per capita consumption was studied with respect to its description of tree, habitat and occurrence. Comparative study of soya oil is carried with composition and physico-chemical properties. The fatty acid composition was determined by GLC.
- Rice bran oil: It is non conventional oil produced from rice bran. Utilization of rice bran by-product is carried for production of oil. Evolution of compositional and physico-chemical properties, health benefits with medicinal uses were determined.
- Orange seed oil: Evolution of importance of environmental conditions with tree description, habitat and occurrence was identified. The composition and properties were determined and comparative study was carried with its properties. Use of orange seed oil in pharmaceuticals was determined.

- Mahua seed oil: The standard method of oil extraction, its utilization, nutritional properties and health benefits were determined.
- Karanj seed oil: Karanj seed oil is commonly used for meditational purpose. It is having health benefits. Chemical composition and all properties were determined.

Materials and Method

Determination of Acid Value

Procedure

Mix the oil or melted fat thoroughly before weighing. Weigh accurately about 5 to 10 g of cooled oil sample in a 250 ml conical flask and add 50 ml to 100 ml of freshly neutralized hot ethyl alcohol and about one ml of phenolphthalein indicator solution. Boil the mixture for about five minutes and titrate while hot against standard alkali solution shaking vigorously during the titration. The weight of the oil/fat taken for the estimation and the strength of the alkali used for titration shall be such that the volume of alkali required for the titration does not exceed 10 ml.

Calculation

$$\text{Acid value} = \frac{56.1 \text{ VN}}{W}$$

Where

- V = Volume in ml of standard potassium hydroxide or sodium hydroxide used
- N = Normality of the potassium hydroxide solution or Sodium hydroxide solution; and
- W = Weight in g of the sample

The acidity is frequently expressed as free fatty acid for which calculation shall be Free fatty acids as oleic acid = 28.2 VN per cent by weight W

Acid value = Percent fatty acid (as oleic) x 1.99

Determination of Fatty acid composition of Oils and Fats by Gas Liquid Chromatography

Prepare the methyl esters of the fatty acids. The method using boron trifluoride gives good results and is preferable to alternative methods which may be used when boron trifluoride is not available. Because of the toxic character of

boron trifluoride various operations must be performed under a ventilated hood. All glass ware must be washed with water immediately after use. If the oil or fatty acids include fatty acids containing more than 2 double bonds it is advisable to purge the air from the methanol and the flask by passing a stream of nitrogen into the methanol for a few minutes.

Transfer about 350 mg of clear oil to a 50 ml conical flask, add 6 ml of 0.5 N methanolic sod. hydroxide solution, 7 ml of boron trifluoride solution and a boiling chip. Fit the condenser to the flask. Boil under reflux until the droplets of oil disappear (5- 10 minutes).

Add the appropriate amount of boron trifluoride solution with a bulb or automatic pipette through the top of the condenser. Continue boiling for 2 minutes. Add 2- 5 ml of heptane to the boiling mixture through the top of the condenser. Continue boiling for 1 minute. Withdraw the source of heat and then remove the condenser. Add a small amount of saturated Sod. Chloride solution to the flask in order to bring the level of liquid into the neck of the flask.

Transfer about 1 ml of the upper layer (Heptane solution) into a test tube with a ground glass neck and add a little anhydrous Sod. Sulphate to remove any trace of water. This solution will contain about 5 – 10% of methyl esters and may be injected directly into the column of gas liquid chromatograph.

Results and Discussions

Acid value of oils

The acid values of different vegetable oils under study are shown below:

Acid value of oils

Oil	Acid Value(mg/KOH)
Soyabean Oil	2.5
Rice Bran Oil	1.3
Mahua Seed Oil	3.1
Karanj Oil	2.6
Orange Seed Oil	2.1

It is observed that the acid value of Mahua seed oil is highest (3.1) amongst all other oils. Rice bran oil has lowest acid value (1.3) than all other oils. Acid value of soyabean oil (2.5) is on a higher side but less than that of Mahua seed oil. Acid value of Karanja oil and Orange seed oil are 2.6 and 2.1 respectively.

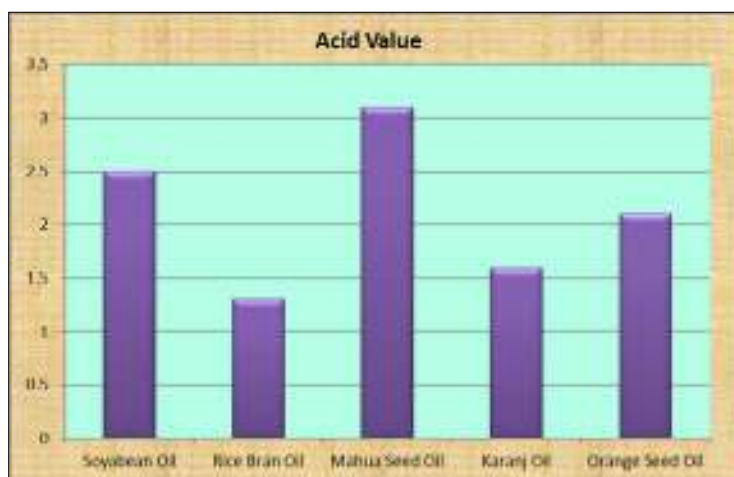
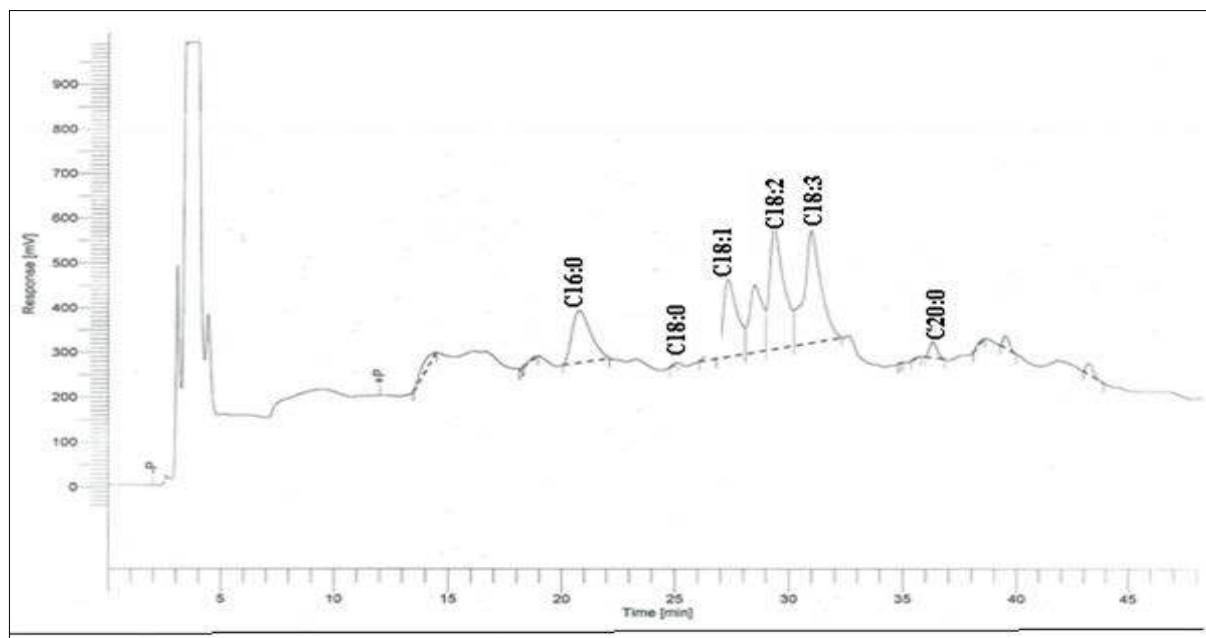


Fig 1: Fatty acid composition of vegetable oils

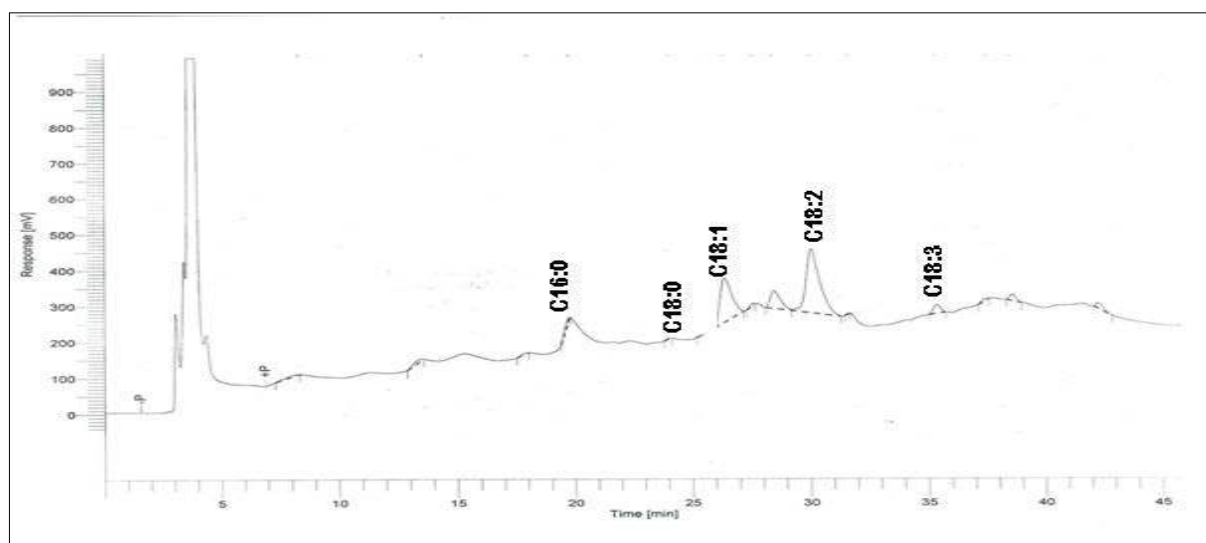
Fatty acid composition (% w/w) of Soyabean Oil by GLC

Fatty acids (by wt.%)	Present work
Palmitic (C16:0)	13.59
Stearic (C18:0)	1.50
Oleic (C18:1)	15.34
Linoleic (C18:2)	24.31
Linolenic (C18:3)	28.74
Arachidic acid (C20:0)	12.10
Others	4.42

**Fig 2:** GLC Graph of Soyabean Oil**Fatty acid composition of Rice bran Oil by GLC**

Fatty acids (by wt.%)	Present work
Palmitic (C16:0)	28.80
Stearic (C18:0)	0.31
Oleic (C18:1)	9.80
Linoleic (C18:2)	47.90
Linolenic (C18:3)	3.30
Others	9.89

Others means:- Myristic (14:0), Arachidic, (20:0) and Behenic (22:0)

**Fig 3:** GLC Graph of Rice bran Oil

Fatty acid composition of Mahua seed Oil by GLC

Fatty acids (by wt.%)	Present work
Palmitic (C16:0)	25.30
Stearic (C18:0)	14.99
Oleic (C18:1)	13.45
Linoleic (C18:2)	26.59
Linolenic (C18:3)	2.70
Others	16.92

Others means Myristic (14:0), Arachidic, (20:0) and Behenic (22:0)

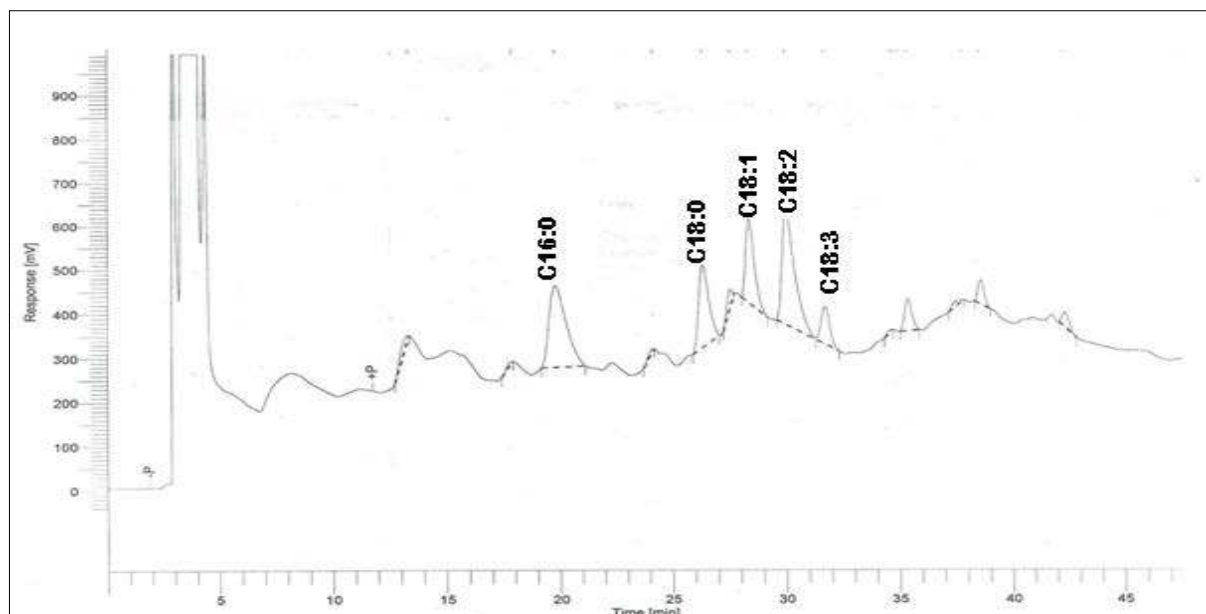


Fig 4: GLC Graph of Mahua seed Oil

Fatty acid composition of Karanja Oil by GLC

Fatty acids (by wt.%)	Present work
Palmitic (C16:0)	32.2
Stearic (C18:0)	1.93
Oleic (C18:1)	47.02
Linoleic (C18:2)	6.83
Linolenic (C18:3)	3.55
Others	8.67

Others means *-Myristic (14:0), Arachidic, (20:0) and Behenic (22:0), Lignoceric acid

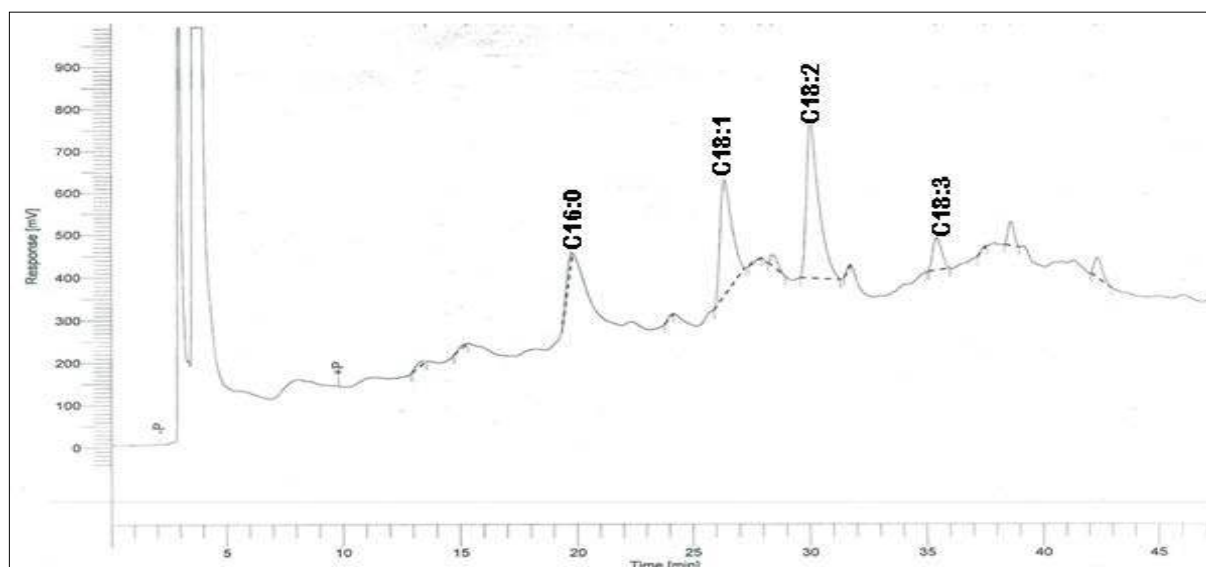


Fig 5: GLC Graph for Karanja oil

Fatty acid composition of Orange seed Oil by GLC

Fatty acids (by wt. %)	Present work
Palmitic (C16:0)	9.24
Stearic (C18:0)	2.78
Oleic (C18:1)	49.24
Linoleic (C18:2)	22.86
Linolenic (C18:3)	11.48
Others	4.4

Others means *-Myristic (14:0), Arachidic, (20:0) and Behenic (22:0)

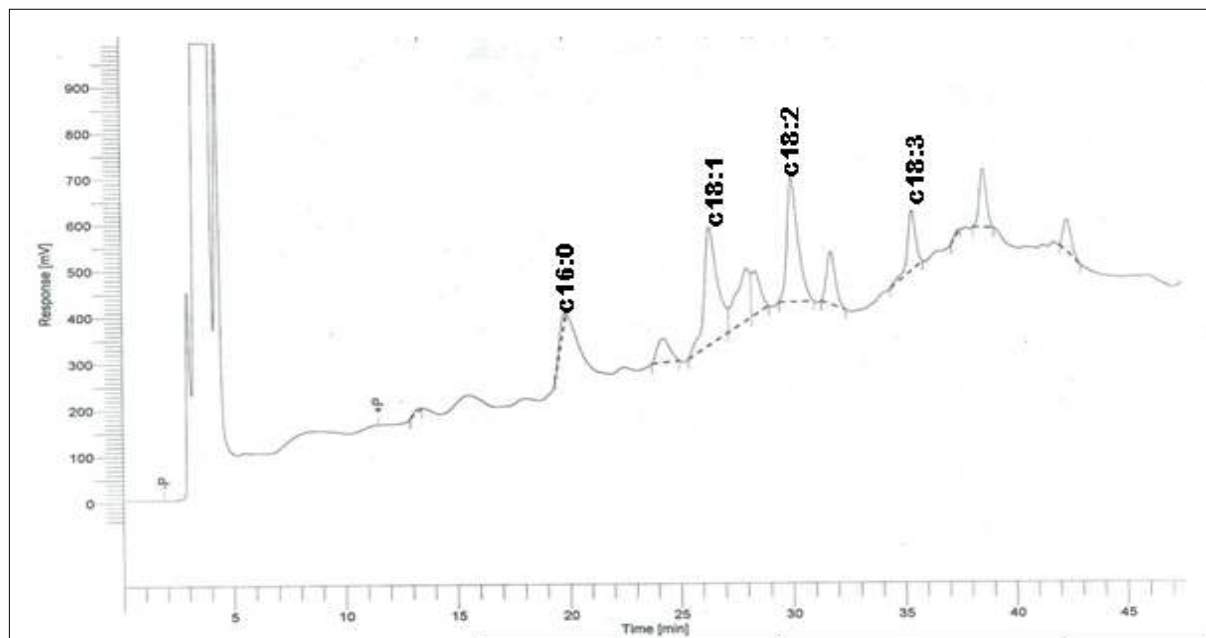


Fig 6: GLC Graph for Orange seed

Comparative Fatty acid composition of oils

Fatty acids (bywt. %)	Oils				
	Soyabean	Rice Bran	Karanja	Mahua	Orange Seed
Palmitic (C16:0)	13.59	28.80	32.2	25.30	9.24
Stearic (C18:0)	1.50	0.31	1.93	14.99	2.78
Oleic (C18:1)	15.34	9.80	47.02	13.45	49.24
Linoleic (C18:2)	24.31	47.90	6.83	26.59	22.86
Linolenic (C18:3)	28.74	3.30	3.55	2.70	11.48
Others	16.52	9.89	8.67	16.92	4.4

Conclusion

India is one of the largest producer of oilseeds and it is also having large no of processing units. The environmental conditions are favourable so oilseeds production is increasing per year. All conventional and nonconventional oilseeds oil was extracted with soxlet extraction. This section has mainly focused on chemical compositional study of different extracted oil and its physic-chemical properties. The major contribution of this work are summarised as fallows:

- Acid value of Mahua seed oil is highest (3.1) amongst all other oils. Rice bran oil has lowest acid value (1.3) than all other oils. Acid value of soyabean oil (2.5) is on a higher side but less than that of Mahua seed oil. Acid value of Karanja oil and Orange seed oil are 2.6 and 2.1 respectively.
- Palmitic acid content of Karanj seed oil is highest amongst all that is 32.2 followed by Rice bran oil of 28.8. Mahua seed oil has 25.3 and soyabean oil has 13.59. Orange seed oil has lowest that is 9.24. Stearic

acid content of Mahua seed oil is highest that is of 14.99 and Rice bran oil has lowest 0.31. Oleic acid content of Orange seed oil is higher it is of 49.24 followed by Karanj seed oil of 47.02. Linoleic acid content of Rice bran oil is highest (47.90) and Karanj seed oil has lowest that of 6.83. Linolenic acid content of soyabean oil is higher than all other oils it is of 28.74 and Rice bran has lowest of 3.3.

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