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Studies on the Lipid Classes and Fatty Acid Compositions of Petuli (Trewia nudiflora Linn.) Seed oil

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Abstract

Studies were carried out on the lipid classes and fatty acid compositions of petuli seed oil. It was observed that petuli seed grown under the soil and climatic condition of Bangladesh contains about 22% pale yellow coloured oil. The total lipids were fractionated into three major lipid classes, neutral lipid glyco lipid and phospho lipid by silicic acid column chromatography. The neutral lipid was accounted to 92.5% of the total weight of the lipid applied. The oil was also fractionated into mono, di and triglyceride by silicic acid column chromatography. The triglyceride was counted for over 90% of the total weight of the oil. The fatty acid compositions of the oil were analyzed by Gas liquid Chromatography and found the major fatty acid α-elaeostearic acid 38.50%, oleic acid 34.35%, linoleic acid 26.15% and small amount of arachidic acid 1%.

Key words : Petuli, Fatty acid compositions, Gas liquid Chromatography, Total lipids

Introduction

Petuli is an uncultivated medium size tree. It grows more or less in all the districts of Bangladesh but grows well in the northern region of the country. The tree generally grows in moisty and swampy places. The wood of the tree is good for making packing cases, tea boxes, agricultural implements, slate, picture frames, toys and root of the tree is used to relieve flatulence and gout (Anon 1976, Gani 1998). The tree bears a lot of fruits, but its seed is neglected although it is a good source of non-edible oil. It's seed contains about 22% pale yellow coloured oil which may be a cheap raw material in surface coating industry. The oil is beneficial for rheumatism (Samad 1966). The oil shows good stability in accelerated oxidation tests inspite of its relatively higher percentage of unsaturation (Reimenschneider 1945). The compositions of the oil depend on some factors such as climetic condi tions, soil type, rainfall, temperature and maturity of the seeds (Sallans 1964). The physico-chemical properties of the oil are directly related to their lipids (Rahman *et al* 2007). Hence the object of the study is to evalute the lipid classes and fatty acid compositions of the petule seed oil.

Materials and Methods

Ripe and mature petuli seeds were collected from locally. The seeds were then deshelled manually and the kerenels were dried in the sun for 2-3 days. The sun dried seeds were crushed into smaller particles in an iron morter. The oil was then extracted in a Soxhlet apparatus with light petroleum ether (40-60^{o}C) for about 8 hours. The extracted solvent was removed by using a rotary vacuum evaporator under reduced pressure and calculated the percentage of the oil content. The specific gravity of the oil was determined at 28^{o}C with the help of a pycnometer. Moisture and volatile matters and refractive index of the oil were estimated by the Standard IUPAC method (Anon 1979). Saponification value, Iodine value, peroxide value and unsaponifiable matters in the oil were also determined by the Standard AOCS method (Anon 1980) Hanus method was followed to determine the iodine vale of the oil (Anon 1955).

Fractionation of lipid compositions of Petuli seed oil

The total lipids were fractionated into three major lipid classes by Silicic acid (E. Merak. Darmastad, Germany 70, 230 mesh) Column Chromatography (Rouser *et al* 1967). The

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Silicic acid was first activated at 120°C over night and again for 1 hour immediately before the column was prepared. Then the Silicic acid was hydrated with 5% (w/w) water. A slurry of 25%. of silicic acid in chloroform was poured into the column. Now about 0.3 gm of oil was dissolved in 15ml of chloroform and quantatively transferred to the column. Neutral lipid was eluted with 80 ml chloroform, glycolipid with 200ml acetone and phospholipid with 175 mL methanol respectively. The elution was controlled with a flow rate of 0.5ml/min. The complete elution of each fraction was monitored by micro slide thin layer chromatography to ensure uniformity of separation of each class of lipid. The eluted solvents were collected in a weighted flux. The fractions thus obtained were evaporated in a rotary vacuum evaporator under reduced pressure before being weighted. The weight percentage of each fraction was estimated by gravimetric method.

Separations of glycerides

The whole oil was separated into mono, di and tri-glyceride fractions by Silicic aic Column (E.Merck, Darmstadt, Germany 70-230 mesh). At first the Silicic acid was activated at 120°C overnight and again for 1 hour immediately before the column was prepared. The Silicic acid was hydrated with 5% water ($^{W}/_{W}$). A slurry of 25g of Silicic acid in chloroform was poured into the column. One gm oil was dissolved in 10ml of chloroform and quantatively transferred to the column. The triglyecride was eluted with 200 mL benzene dieglyceride with 200mLl a mixture of diethyl ether and benzene (1: 9 v/v), and monoglyceride with 200mL diethyl ether. The elution was controlled at a flow rate of 1.5-2 mL/min. The elution of each fraction was monitored by micro slide thin layer chromatography to ensure uniformity of separation of each class of glyceride. The eluted solvents were collected in weighted flax. The fractions thus obtained were evaporated in a rotary vacuum evaporator under reduced pressure before being weighted. The weight percentage of each fraction was estimated by gravimetric method.

Analysis of fatty acid compositions

The fatty acid compositions of petuli seed oil were analyzed as their methyl ester which was prepared by the Boron triflouride methanol method (Gafur *et al* 1993). A GCD Pye Unicam Chromatography equipped with a flame ionization detector and a glass column (1.8 m×4m.md) was packed with 6% Butanediol succinate polyesters on solid support Anakorm ABS (100/120 mesh) was used for the separation of fatty acid. The column was operated isothermally at 190°C with a carrier gas nitrogen at flow rate of 30ml/min. The injector and detector temperature were maintained at 200°C for all GLC analysis. The Gas Chromatographic peaks were identified by comparison with standard ester with respect to retention times against equivalent carbon length (ECL). The peak areas were measured by multiplying peak-height by width at half hight. The percentage of each peak was calculated as the percentage of the total area of all the peaks.

Results and Discussion

The solvent extraction method of petuli seed yielded 21.5% pale yellow coloured oil. The physico-chemical characteristics of the Petuli seed oil were determined by the conventional methods and the results are presented in Table I, From the results, it was found that no remarkable results were observed in the physico-chemical characteristics, only the iodine value was found to be higher in the oil which in indicated that the amount of unsaturated fatty acids were predominant in the oil. But the specific gravity and refractive index of the oil were normal in comparison with other vegetable oils (Hilditch 1949).

Table I: Physico-chemical characteristics of Petuli seed oil.

1	Percentaage of oil	21.5 ± SE (0.058)
2	Refractive index	1.456 ± SE (0.00058)
3	Melting point	30-31°C ± SE(0.58)
4	Specific gravity at 28°C	0.920 ± SE (0.00058)
5	Free fatty acid as oleic(%)	3.2± SE (0.058)
6	Moisture and volatile matters (%)	0.115 ± SE (0.00058)
7	Iodine value	148 ± SE (0.58)
8	Saponification value	185 ± SE(0.58)
9	Unsaponifiable matters(%)	0.25 ± SE(0.0058)
10	Peroxide value	0.52 ± SE (0.0058)

The total lipids of the petuli seed oil were separated into three major lipid classes by Silicic acid Column Chromatograph and the results are given in Table II. From the results, it is observed that the neutral lipid was found to be over 92% of the total weight of the lipid. The whole oil was fractionated into mono, di and triglyceride by means of

Column Chromatography and the results are shown in Table III. From the results it is evident that the triglyceride in the oil accounted for over 90% of the total weight of the oil. The fatty acid compositions of the oil were analyzed by the Gas liquid Chromotography and the results are shown in Table IV. From the results, it is found that the unsaturated fatty acids present in the petuli seed oil were mainly α-elaeostearic acid (38.50%), oleic acid (34.35%), linoleic acid (26.15%) and small amount saturated fatty(arachedic 1%) acid.

Table II: Lipid compossitions of petuli seed oil (wt%)

1	Neutral lipid	92.5 ± SE (0.058)
2	Glycolipid	5.3 ± SE (0.058)
3	Phospholipid	1.4 ± SE (0.058)

Table III: Glyceride compositions of petuli seed oil (wt%)

1	Monoglyceride	3.5 ± SE (0.058)
2	Diglyceride	4.5 ± SE (0.058)
3	Triglyceride	90.5 ± SE (0.058)

Table IV: Fatty acid compositions of petuli seed oil (wt%)

1	α-elaeostearic acid ($C_{18:3}$)	38.50
2	Oleic acid ($C_{18:2}$)	34.35
3	Linoleic acid ($C_{18:1}$)	26.15
4	Arachidic acid ($C_{20:0}$)	1.00

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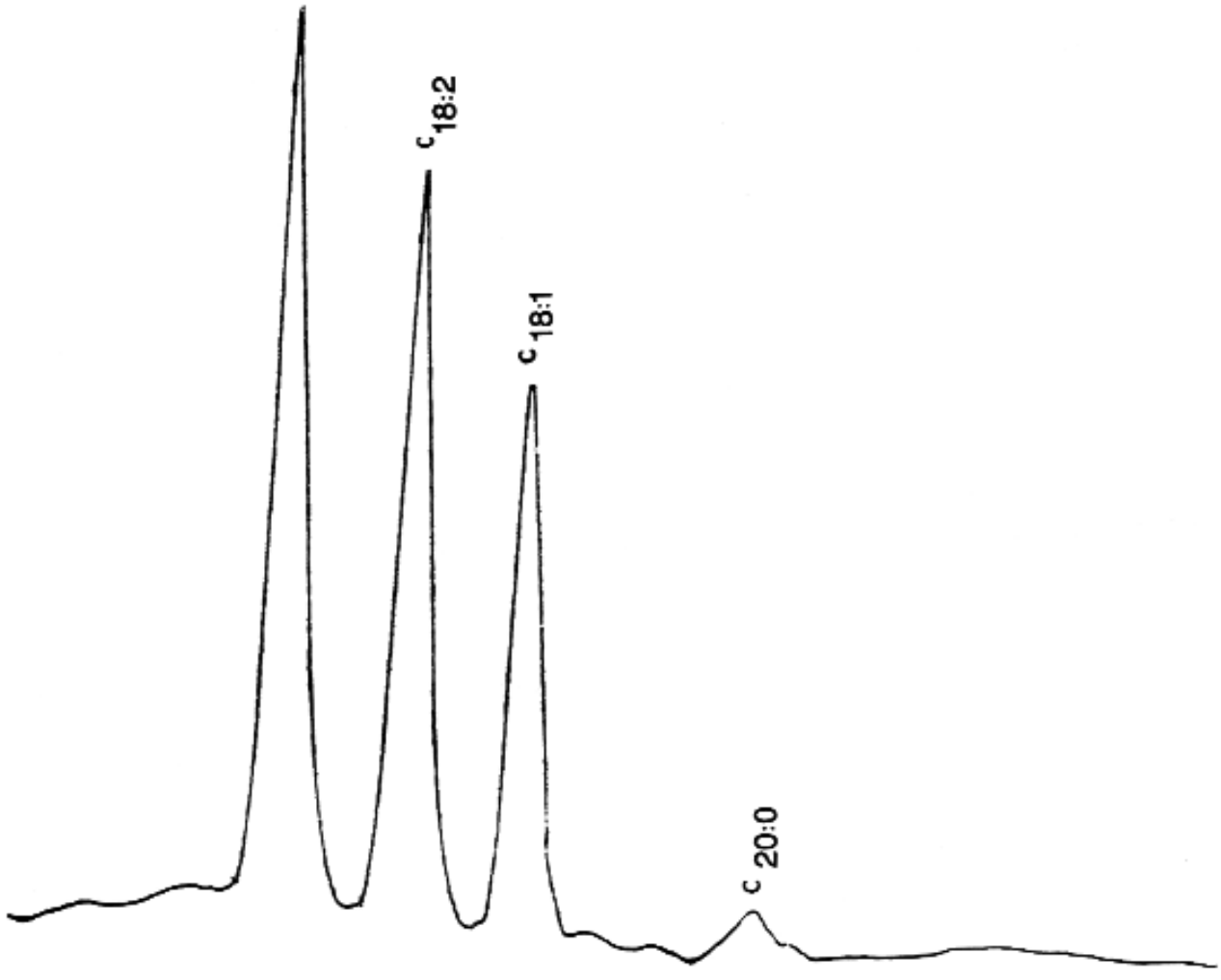

Fig. 1: Chromotograph of petuli seed oil

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