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Fatty acid composition and elemental analysis of seed oil of tectona grandis collected from Dehradun, Uttarakhand, India.

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Abstract: To study oil contents and fatty acid composition of Tactona grandis seeds gas chromatography (GC) and gas chromatography mass spectrum (GCMS) were employed. The seed oil contents (dry basis) was 39.27%. Elemental analysis of seed oil shows that Calcium (1.98%), Magnesium (1.20%), Potassium (0.010%), Nitrogen (0.026%), Chloride (2.83%), Zinc (0.0051%), Nickel (0.0025 %), Manganese (0.0042 %) and Iron (0.015 %). The evaluation of fatty acid composition using gas chromatography (GC) and gas chromatography mass spectrum (GCMS) revealed that, oleic (28.4578%), linoleic acid (56.2071 %), Palmitic acid (10.1302%) and Octadecenoic acid methyl ester (5.2049%).
Keywords: Tactona grandis; Seed oil; Fatty acid composition.

INTRODUCTION:

Tectona grandis Linn. (Common name – Teak; Family -Lamiaceae) is one of the most famous timbers in the world and is renowned for its dimensional stability, extreme durability and hard which also resists decay unprotected by paints and preservatives. It is commonly found in India and other South-East Asian countries[1,2].

According to Ayurveda, *Tectona grandis* wood is acrid, cooling, laxative, sedative to gravid uterus and useful in treatment of piles, leucoderma and dysentery. Roots are useful in anuria and retention of urine [3,4]. The flowers are acrid, bitter dry and cures bronchitis, biliousness, urinary discharges etc [3]. According to Unani system of medicine, oil is useful in scabies whereas wood is best for headache, biliousness, burning pains particularly over the region of liver. It allays thirst, and act as anthelmintic, expectorant and anti- inflammatory [3,4]. Due to biological importance[5,6] fatty acids have gained importance in food nutrition evaluation[7-10] and in the diagnosis of certain diseases and pharmacology [11] Fatty acids with unsaturation, either monounsaturated or polyunsaturated, have been used in lowering the risks of heart disease, against inflammation and in enhancing the immunity or immune system [12-17]. A number of analytical techniques have been applied for the determination of fatty acids. These include: enzymatic, spectrophotometric, HPLC [18-20] gas

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chromatography (GC) [21-23] .GC-MS is the method of choice for the analysis of fatty acids due to various reasons like speed, resolutions and sensitivity [24,25]. In the present study fatty acid composition and Elemental analysis of seed oil of *Tactona grandis* collected from Dehradun, Uttarakhand, India were determined.

MATERIALS AND METHODS

Collection of plant materials

Tactona Grandis seeds were collected from the Graphic Era Campus Clement town, Dehradun, in the month of January 2011. The seed were identified by Dr. Sumer Chand, Scientist, Forest Research Institute, Dehradun. The ripe seeds were collected and the damaged seeds were discarded. The seeds were cleaned, de-shelled and air dried in the shade for few days.

Extraction of material

50 gm of *Tactona grandis* seeds were taken and petroleum ether was used as solvent. Thus extract was obtained in about 08 hours. The moisture is present in the extract so Anhydrous Sodium Sulphate was added to remove the moisture from the extracted solution. The oil was separated from the solvent using distillation assembly.

The percentage of oil content can be calculated as below

$$\% \text{ of oil} = \frac{\text{Weight of oil obtained in gm}}{\text{Weight of seed taken in gm}} x100$$

Preparation of Fatty acid methyl esters

Fatty acids are polar compounds and are not volatile. For gas chromatographic analysis it is necessary that the sample to be analyzed must be volatile. In order to make fatty acids present in the oil volatile, derivatizaion is performed prior to GC-MS analysis. Methylation is the most general method of converting non-volatile fatty acids into volatile fatty acids methyl esters FAMEs [26]. Methylation of fatty acids was performed with BF_3 – methanol as derivatizing reagent, which is the most accepted procedure for converting fatty acids into FAMEs [23]. Derivatizaion was performed according to the AOAC standard reference method [27].

GC condition for analysis of fatty acid profile

Fatty acid composition of the seed oil was determined using a NUCON series 5700 gas chromatograph equipped with the flame ionization detector and a stainless steel packed column 10 % DEGS having internal diameter 2mm and length 2.0cm . The detector temperature was programmed for 200°C with a flow rate of 25ml/min. The injector temperature was set at 200°c .Column temperature was programmed from 70°c to 200°c with the increasing rate of temperature 6°c/min. Nitrogen was used as the carrier gas. Hydrogen 40ml/min. and air 60ml/min were used for flame burnt. The peaks were identified by measuring the retention time of the samples and comparing the same standards analyzed under the same conditions.

GC-MS analyses: The analyses was done using a Hewlett-Packard gas chromatography HP 5973 Series II equipped with a DB-5 fused silica capillary column (30m x 0.25 mm; film thickness 0.25 µm) and DB 5973 mass selective detector. Analytical conditions were: injector and detector temperature: 250 and 260°C respectively. The oven temperature was programmed from 60°C to 220°C at rate of 6°C/ min. Helium gas was employed as the carrier gas at 1 ml/min flow rate; source 70 eV. Essential oil sample was diluted with normal hexane and 0.1 µl was injected into the oven. The components of the oil were identified by comparison of their mass spectra with those of standard mass spectra from NIST Library (NIST 05).

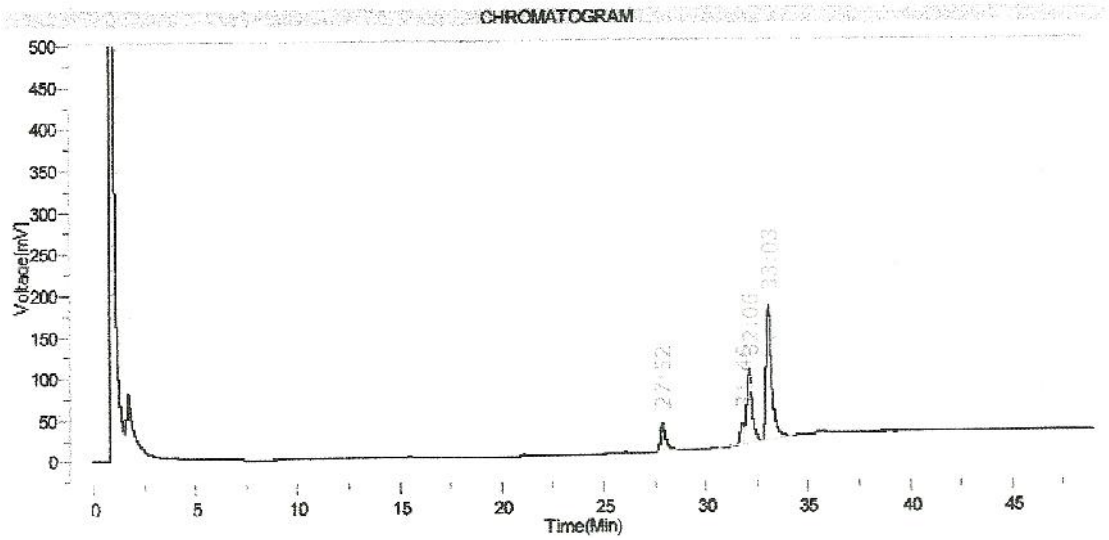

Fig. No. 1: GC of seed oil of *Tectona grandis*

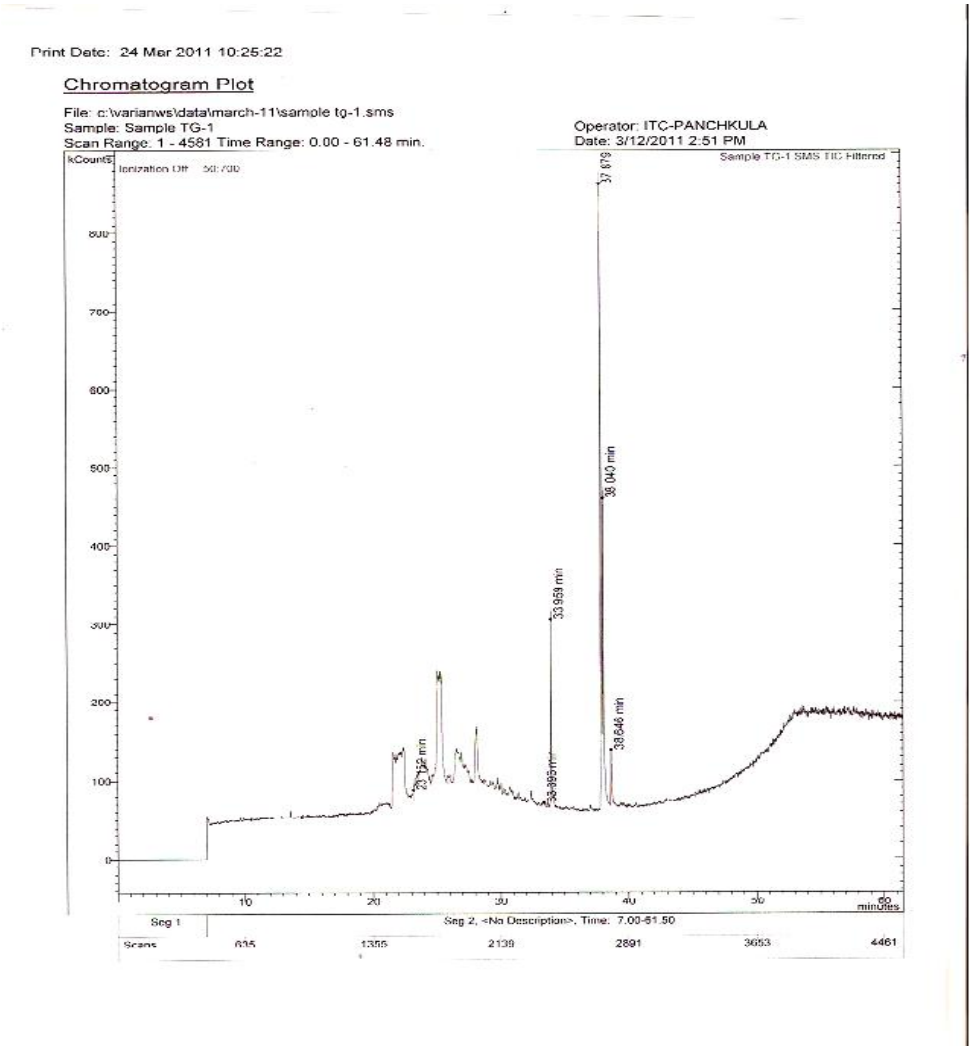

Fig. no. 2: GCMS of seed oil of *Tactona grandis*

ELEMENTAL ANALYSIS PARAMATERS:

The metal composition Zinc, Iron, Nickel and Manganese of the seeds oil were determined by using an Atomic Absorption Spectrophotometer (Model no.–Varian 240FS + GTA120), after acid digestion. Calcium and magnesium was determined by complexometric titration with 0.1 M EDTA, by using Erichrome black T indicator and calculated. Potassium was determined by flame photometer model No. ESICO 1381 by using the reference standard (Merck) and calculated on the basis of reading and dilution of the sample. Nitrogen was determined by Kjeldhal method. Chloride was determined by Chromyl chloride test. Gas Chromatography analysis gives the following results-

Table No.1: Elemental Analysis of seed oil of *Tactona grandis*

Parameter	Tactona grandis
Calcium %	1.98 %
Magnesium %	1.20 %
Potassium %	0.010 %
Nitrogen %	0.026 %
Chloride %	2.83 %
Zinc %	0.0051 %
Nickel %	0.0025 %
Manganese %	0.0042 %
Iron %	0.015 %

Table 2.Fatty acid composition of *Tactona grandis* seed oil by(Gas Chromatography)

S.No.	Composition	Percentage (%)
1.	Palmitic acid	10.1302
2.	Stearic acid	Not detected
3.	Oleic acid	28.4578
4.	Linoleic acid	56.2071

RESULTS AND DISCUSSION:

Table No. 2 summarizes the results obtained from gas chromatography analysis showing the fatty acid composition and table No. 3 summarizes the results obtained from the GCMS analysis showing the relative concentration of individual esterified fatty acids. Linoleic acid 56.2071% was found in the sample in highest concentration. Among the other fatty acid with concentration are palmitic acid (10.1302%), Oleic acid (28.4578%) and Octadecenoic acid methyl ester (5.2049%). Elemental analysis of seed oil shows that Calcium (1.98%), Magnesium (1.20%), Potassium (0.010%), Nitrogen (0.026%), Chloride (2.83%), Zinc (0.0051%), Nickel (0.0025 %), Manganese (0.0042 %) and Iron (0.015 %).

Table 3.Fatty acid composition of *Tactona grandis* seed oil by (Gas Chromatography mass spectrum)

Peak	RT	Compound	Molecular Weight	% in Total Oil
1.	33.959	Hexadecanoic acid methyl ester (Palmitic acid)	270.26	10.1302
2.	33.393	9- Hexadecenoic acid, methyl ester	268.24	…….
3.	37.879	9,12- Octadecadienoic acid methyl ester (Linoleic acid)	294.26	56.2071
4.	38.040	9- Octadecenoic acid methyl ester (Oleic acid)	282.26	28.4578
5.	38.646	Octadecenoic acid methyl ester	298.29	5.2049

CONCLUSION

The seed oil of *Tactona grandis* has high yield 39.27%. *Tactona grandis* seed oil is an unsaturated oil due to the presence of sufficient amounts of oleic and linoleic acids (84.6649%). Hence the *Tactona grandis* oil has a great potential for various application such as surface coating. So, more research on *Tactona grandis* seed oil is useful in the future to explore its potentials for future application. Elemental analysis of seed oil shows that oil is rich source of minerals. The oil can be utilized to treat number of disease is that are mainly caused due to deficiency of these minerals.

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