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Research Article

Analysis of Fatty acids of the seeds and leaf of the *Albizia lebbeck* friuts

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ABSTRACT

Fatty acid compositions of the oil of seeds and leaf of the *Albizia lebbeck* were investigated. The fatty materials of seeds and leaf were found to be 2.3 and 2.8 %, respectively. The oil of seed was opaque, viscous and almost semisolid. Iodine value and saponification value of the extracted oil of seed were 133.0 and 201.0, respectively. Palmitic (55.4%), linoleic (19.1%), arachidic (6.9%), lignoceric (2.6%) and behenic (16.1%) are the major free fatty acids in seeds but the same in leaf are palmitic (26.2%), behenic (42.5%) and stearic (31.3%) acids. Palmitic (47.2%), stearic (8.5%), linoleic (25.4%), and behenic (11.2%) acid along with small amount of oleic (1.5%), lignoceric (1.1%) acids were found as bound fatty acid in the seed but in leaf the bound fatty acids were identified as palmitic, stearic and linoleic acid.

Keywords: *Albizia lebbeck, Fatty Acid Methyl esters* (FAMEs), *Free* Fatty Acid (FFA), Bound Free Acid (BFA), Iodine value, Saponification value and GLC (Gas liquid Chromatography).

INTRODUCTION

The genus Albizia comprises approximately 150 species. These are mostly trees and shrubs native to tropical and subtropical regions of Asia and Africa. *Albizia lebbeck* is a fast-growing, medium-sized deciduous tree. Albizia lebbeck seeds are small, oblong, approximately 9 by 7 mm long and broad, compressed and light brown in color. *Albizia lebbeck* is an important medicinal plant[1]. The leaves have alkaloids, tannins and saponins which have therapeutic value. Fatty acids like oleanolic, docosanoic have been reported[2] from pods and seeds of *Albizia lebbeck*. Anti bacterial activity of the seed extract against diarrhoea have also been reported[3]. A lot of useful properties are found in different parts of this plant and seeds [4-11]. Fatty acids composition of the seed of *Albizia lebbeck* of South Iran has been studied[12]. Fats are taken as food in diet and in the metabolic process these fats are broken down and absorbed in our blood stream.

Fatty acids play many important functions in the biological system including energy storage especially when free sugar is not sufficient in the biological system. Plant seeds are the vital sources of lipids as well as complex carbohydrates, proteins and secondary metabolites. They play a significant role in the normal biological functions. These are also used for industrial as well as pharmaceutical purpose[13]. With the increasing demand of vegetable oils in the country, the investigation of the seed and leaf oil of *Albizia lebbeck* has been undertaken.

MATERIALS AND METHODS.

Plant materials: Ripened fruits (containing seeds) and leaves of *Albizia lebbeck* have been collected from the medicinal plant garden of Bangladesh Council of Scientific and Industrial Research, (BCSIR, Laboratory; Dhaka). The seeds and leaves were separated, cleaned and dried separately. The dried seeds and leaves were powdered separately in a grinding machine and the powders were preserved in separate airtight containers for investigations.

Extraction: Dried powders seeds and leaves were taken in the two round bottom flasks separately and extracted with *n*-hexane (bp. 68^{o}C; 200 mL) for 30 mins under reflux condition[14]. The resulting extracts were cooled and filtered. The process was repeated twice. The extracts were taken separately to a round bottom flask and evaporated to dry mass under reduced pressure at 40^{o}C in a rotavapor.

Physico-chemical study of the oil: The physico-chemical properties like iodine values and saponification values of the seed oil were determined by following the standard methods[15] and the results are given in Table 1.

Free sugar analysis: Measured amount of extractive free powder was further extracted with dichlorolomethane followed by aqueous 80% ethanol. The aqueous 80% ethanol extract was concentrated under reduced pressure in a rotavapor with added water repeatedly to remove the ethanol and thus converts the extract in aqueous solution. The sugar components were identified from the aqueous extract by paper chromatography in a usual way where glucose and maltose were identified as free sugars.

Isolation of Fatty materials: Free and bound fatty acids were isolated from the hexane extract following the standard methods[16].

Identification and quantification of fatty acids: The fatty acid constituents of both **FFA** and **BFA** were converted into their methyl ester and fatty acids were identified as well as quantified by GLC as their methyl esters prepared by complete esterification of extracted oil using BF_3-MeOH complex [16].

The FAMEs were analyzed by a Shimadzu 9A Gas Chromatograph (Japan) fitted with a flame ionization detector (FID) and an electronic integrator equipped with BP-50 column 30 m x 0.25 mm i.d. and 0.35 ext. diameter. Nitrogen (N_2) was passed as carrier gas with the flow rate of 2-3 mL/min. The separation was affected at 120^{o}C-270^{o}C. The following temperature program was carried out during GC analysis: initial oven temperature 120^{o}C hold 1 min. increases at a rate 7^{o}C min^{-1} to 270^{o}C for 5 min. The oven, injection and detector temperature were fixed at 120^o, 280^o and 290^{o}C, respectively. Standard FAMEs (E. Merck) were used for the identification and quantification of the peaks. The amounts of fatty acids were calculated from the peak areas computed by LKB 2220 electronic recording integrator and the results are given in Table-2.

RESULTS AND DISCUSSION

The ripened fruits (containing seeds) of *Albizia lebbeck* and the leaves of the plant collected. The seeds and leaves were cleaned, dried and powdered separately. The oil of seeds and leaves were separately extracted with *n*-Hexane. The extracts were found to contain 2.3 and 2.8% fatty oil for seed and leaves, respectively. Both the oils were opaque, viscous and almost semi solid. It was freely miscible in chloroform and *n*-hexane but immiscible in water. Iodine value and saponification value of the extracted oil of seed were found to be 133.0 and 201.0, respectively, which is quite similar to the range of soyabin oil[17]. The result of high iodine value indicates that the oil contains the higher proportion of unsaturated fatty acids. The high saponification value (Table 1) of the seed-oil is also an indication of the appreciable quantity of longer chain fatty acids. The higher proportion of fatty-oil present in the leaves indicates that the leaves contains higher amount of lipids.

Paper chromatographic analysis of aqueous extract of seed powder showed the presence of glucose and maltose as free sugar indicating the presence of carbohydrate material as a ready source of energy.

From Table-1, it appears that the major portion of the fatty acid present in the extracted oil in seeds and leaves in bound form are 46.6% and 7.1%, respectively. The bound fatty acids are associated with other organic compounds and hence the proportion of the FFA both in seeds and leaves oil are relatively lower. Again the total fatty acids content of seed (Table-1) is about five times higher in seeds (3.5 + 46.6 = 50.1%) than that of leaves (3.0 + 7.1 =10.1%). This indicates that seeds are the major source of fatty materials in plant kingdom.

In the form of **BFA** seven different fatty acids (Table-2) were present in seeds but the number is three in case of leaves. On the other hand in the form of **FFA** five different fatty acids were detected in seeds and three in leaves. **BFA** and **FFA** contain both saturated and unsaturated fatty acids where the ratio was found to be about **4:1**. It reveals from Table-2, that palmitic acid is the major fatty acids as **FFA** (55.4%) and **BFA** (47.2%) in seeds. Linoleic acid (19.1%) and behenic acid (16.1%) are also found as **FFA** in seeds. But behenic acid (42.5%) is the major **FFA** in leaves along with palmitic acid (26.2%) and stearic (31.3%). On the other hand palmitic acid (29.5%), stearic acid (35.4%) and linoleic acid (35.1%) are found almost same proportion as **BFA** in the leaves of *Albizia lebbeck*. The naturally occurring higher monocarboxylic acids are of even number of carbon atoms usually have straight chains. The present finding follows this. The saturated fatty acid is harmful for human being, which can increase the risk of heart disease from atherosclerosis[18]. The polyunsaturated fatty acids have been reported[19] to have a tendency to lower blood cholesterol level and are protective against cardiac arrhythmias. It also has, beneficial effect on blood lipids, lowering blood pressure and serum cholesterol. The nutritional value of linoleic acid is due its metabolism at the tissue levels, which produced the hormone like prostaglandins[20]. The unsaturated fatty acids linoleic and oleic acids decreases total blood cholesterol and low-density lipoprotein. These are also more prone to oxidation. Some of the unsaturated fatty acids, those

are conjugated to fat-soluble antioxidants, have potential health benefit[21]. So, significant proportions of linoleic acid that was identified as **BFA** and **FFA** in the extracted oil of seeds and leaves of *Albizia lebbeck* may contribute to the medical science and hence the different parts of the plant is used widely in various purpose.

CONCLUSION

The nature of the fatty acid composition and chemical characterization indicates that the oil extracted from the seeds and leaves of Albizia *lebbeck* is not a good source of edible oil but the extracted oil may be used as a good source of palmitic acid as well as this may have some medicinal importance since it contains significant proportion of linoleic acid.

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Table 1
Physico-chemical properties of extracted oil.

Plant materials	Iodine value	Saponification value	% of extracted oil	% of FFA	% of BFA
Seeds	133.0	201.0	2.3	3.5	46.6
Leaf	Not done	Not done	2.8	3.0	7.1

% on the basis of dry powder taken

Table 2
Percent of Fatty acid constituents of extracted oil in seeds and leaf.

Fatty acid	Palmitic Acid (sat^r)	Stearic Acid (sat^r)	Oleic Acid (unsat^r)	Linoleic Acid (unsat^r)	Arachidic Acid (sat^r)	Lignoceric Acid (sat^r)	Behenic Acid (sat^r)
FFA in seeds	55.4	-	-	19.1	6.9	2.6	16.1
FFA in leaf	26.2	31.3	-	-	-	-	42.5
BFA in seeds	47.2	8.5	1.5	25.4	5.2	1.1	11.2
BFA in leaf	29.5	35.4	-	35.1	-	-	-

Table 3
Relative average composition of total saturated and unsaturated fatty acid constituents (FFA + BFA) of extracted oil in seeds and leaf.

Fatty acid (FFA+BFA)	Palmitic Acid (sat^r)	Stearic Acid (sat^r)	Oleic Acid (unsat^r)	Linoleic Acid (unsat^r)	Arachidic Acid (sat^r)	Lignoceric Acid (sat^r)	Behenic Acid (sat^r)
In seeds	51.3	4.3	0.7	22.3	6.0	1.9	13.7
In leaf	27.9	33.3	-	17.5	-	-	21.3

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