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GC-FID AND PHYSICOCHEMICAL STUDIES OF OIL FROM THE LEAVES OF *FICUS ELASTICA* LINN

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ABSTRACT

Ficus elastica leaves were cut into small pieces and extraction of oil was carried out through soxhlet apparatus by using n-hexane for 6 hours. Solvent was separated by rotary evaporator at reduced pressure and green colored oil with 1.92% yield was obtained. Its physicochemical properties were estimated by following standard procedures. Its acid value, saponification value, peroxide value, refractive index and free fatty acid values were 11.16 mg KOH/g, 16.83 mg KOH/g, 15 meq H_2O_2/g, 1.3970 and 5.61% respectively. Fatty acid profile was determined by gas chromatograph coupled with flam ionization detector (GC-FID) after esterification of the oil with methanol in the presence of boron trifluoruide. It contains lauric acid 3.36%, myristic acid 3.12%, butyric acid 3.38%, isobutyric acid 6.50%, caprylic acid 5.41%, caproic acid 27.34%, valeric acid 6.76 %, isovaleric acid 23.59% and capric acid 20.28%. The oil of *F. elastica* contains lower molecular weight saturated fatty acids which are suitable for application in soap and cosmetic industry.

KEYWORDS: Gas Chromatography, *Ficus elastica*, Oil, Fatty acid, Caprylic acid, Capric acid.

INTRODUCTION

Ficus (*Moraceae*) comprises one of the largest genera of angiosperms about 800 species and 2000 varieties of shrubs, herbs and woody trees. These are found in tropical and subtropical worldwide forests[1,2] it is collectively known as fig trees. *Ficus* species are hemi-epiphytic plants.[3] During the early stage of development when competition for sunlight is harsh they use their host to overcome problems of low light conditions.[4] Half the number of ficus species in the world is monoecious and the others are gynodioecious. All of gynodioecious ficus species are old world species.[5] In Egypt, many *Ficus* species are found in gardens, streets, parks and outside the canal banks. Higher plants have been used extensively as a source in medicinal for numerous active constituents for treating human diseases because they contain of high therapeutic value.[6]

Ficus elastica Roxb. Ex Hornem belongs to family *moraceae* commonly known as rubber tree, rubber fig, rubber bush, Indian rubber bush, Assam rubber tree native to northeast India and southern Indonesia.[7, 8] The plant is locally known as India rubber tree.[9] *F. elastica* is also a common house plant. These trees can grow up profusely without any argonomic management and survive well under extreme conditions such as limited water supply and high temperature.[10] It is adaptable for annual pollarding with also a potential fiber value and is distributed in Tamil Nadu.

F. elastica is widely spread evergreen tree upto 30m tall. Its leaves are 7 to 20cm long, with smooth edges and blunt pointed tips. The leaves are thick with deep green colour and about a foot long.[11] Herbivores graze *F. elastica* only little but shy away.[12] *Ficus elastica* was introduced as an ornamental more than 100 years ago.[13] Flora of Pakistan and flora of west Punjab is listed as an "environmental weed, garden thug, naturalized weed" in global compendium of weeds.[14] It is large spreading tree that creates dense shade restricting growth beneath it, and tolerant of shade, drought, and s wide range of soil types.[15] Plants steroids and alkaloids are mostly poisonous even in minute quantities. They are often toxic to man and animals and have dramatic physiological activities and hence they have wide uses in medicines.[16] *F. elastica* possesses antimicrobial activity and the leaves extract is used for treatment of skin allergies, skin infection, anemia, neurodegenerative disorders and hepatic problems, it is also used as diuretic agent. In addition several chemical constituents from *F.elastica* leaves have been investigated.[17] The current study was designed to estimate the

oil contents of leaves of the *ficus elastic* and to determine their physicochemical properties and fatty acid profile for their future fruitful application in the industry.

2. MATERIAL AND METHODS

2.1. Sample Preparation

Ficus elastica leaves were collected from the garden of Pakistan Council of Scientific and Industrial Research (PCSIR) Lahore. Leaves were washed and cut into small pieces to increase surface area of leaves for maximum extraction of oil.

2.2. Extraction of oil

100 g leaves were filled in the thimble and oil was extracted through soxhlet extractor for 6 hours by using *n*-hexane.[18] After extraction, solvent was removed by rotary evaporator under reduced pressure and yield was calculated. It was then stored in the refrigerator for subsequent evaluation of physicochemical properties and GC-FID analysis for fatty acid profile.

2.3. Physico-chemical analysis

The extracted oil was immediately analyzed for peroxide value and saponification value following the method described by the Association of Official Analytical Chemists.[19] Estimation of the percentage free fatty acids as oleic acid was done following the method of Cock and Van Rede.[20] The refractive index of the oil (at room temperature) were determined with Abbe refractometer.[21] The state and colour of the oil were noted using visual inspection at room temperature.

2.4. GC-FID analysis of the Ficus elastica leaves oil

The fatty acids were then esterified with methanol in the presence of boron trifluoride. Esterifies fatty acids were extracted with n-hexane and then evaporated on low heat. Then the analysis was performed on gas chromatograph (GC-14A) coupled with flame ionizer detector and data processing. A PEG capillary column (25m × 0.2 mm id) was used for fatty acid. The column was operated with temperature programming from 150 to 200 ^{0}C. The injection and detector temperature were maintained at 250 to 300 ^{0}C respectively. Flow gas of carrier gas (Nitrogen) was 20 mL/min at split ratio of 1:50. Identification of the component was based on their retention time as compared with those obtained from methyl esters of known fatty acids, analyzed under similar conditions.

3. RESULTS AND DISCUSSION

The physic chemical properties of the oil are reported in the table 1. The color of the oil was light green which may be due to the presence of some contents of chlorophyll. The presence of peroxide and free fatty acid indicates the oxidation process in the leaf. Natural system for the protection and sustain the life of plants indicates that presence of oil in the leave may be due to protection of excessive loss of water. Furthermore, due to oil contents leaves may be more flexible and have capacity to bear harsh weather.

Table 1: Physico-Chemical Characteristics of *Ficus elastica* oil.

Physicochemical Parameters	Results
Colour	Light green
Acid value (mgKOH\g)	11.16
Free fatty acid (%)	5.61
Saponification value (mgKOH\g)	16.83
Peroxide value (meq H_2O_2/g)	15
Refractive index at room temperature	1.3970
State at room temperature	Liquid

Fatty acids were esterified with methanol (C_2H_5OH) in the presence of boron triflouride (BF_3) then its profile was determined by GC-FID. The results showed that it contains lauric acid 3.36%, myristic acid, 3.12%, butyric acid 3.38%, isobutyric acid 6.50%, valeric acid 6.76%, isovaleric acid 23.59%, caprylic acid 5.41%, caproic acid 27.34% and capric acid 20.28% (Fig. 1)

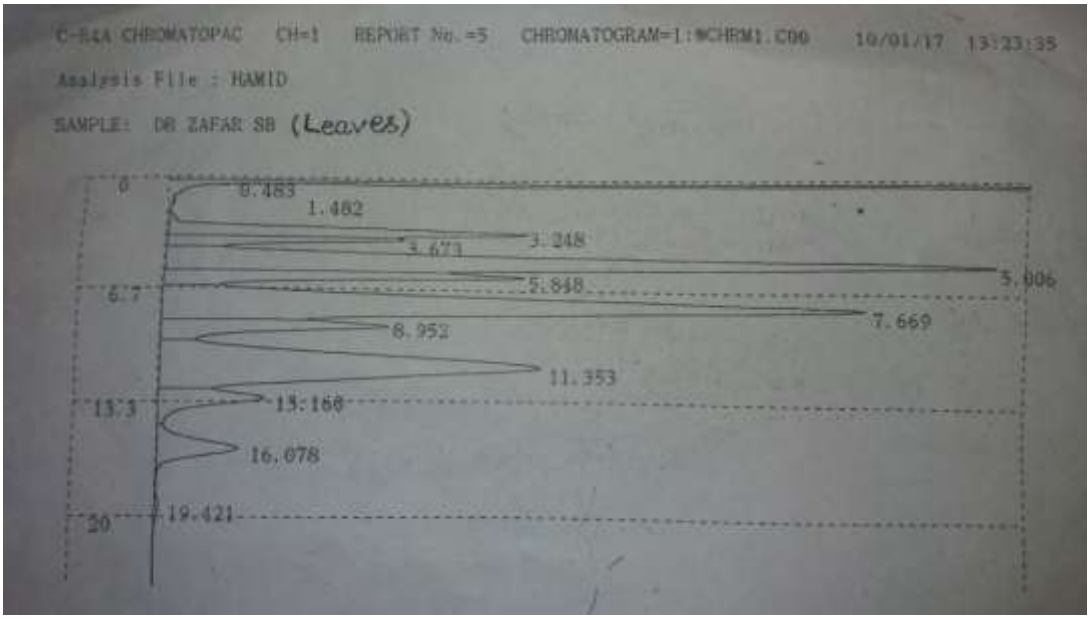

Fig 1: GC-FID chromatogram of *Ficus elastica* leaves oil.

Lauric acid is 12 carbon chain fatty acid (C_{12}:0) and its main application in cosmetic product is for the treatment of acne.[21] Myristic acid (C_{14}:0) in the form of ester isopropyl myristate is used in cosmetic and topical medicinal preparations where good absorption through the skin is desired.[7] Butyric acid a four carbon fatty acid is used in the preparation of various butyrate esters. Due to pleasant tastes or aromas it is used used as perfume and food additives. It is also used as an animal feed supplement due to ability to reduce pathogenic bacterial colonization.[8] Due to powerful odor it is used as a fishing bait additive[9] and in anti abortion protesters to disrupt abortion clinics.[10] It is added to imitate the flavor of chocolate produced by Hershey process. Isobutyric acid also known as 2-methylpropanoic acid are used to eliminate calcium in leather industry. Valeric acid (Pentanoic acid) its primary use is in the synthesis of its esters. Volatile esters of valeric acid tend to have pleasant odors and are used in perfumes and cosmetics. Ethyl valerate and pentyl valerate are used as food additives because of their fruity flavors.[11] Isovaleric acid is common name of 3-Methyl butanoic acid it w seen that it was primary cause of flavors which are added to wine caused by Brettsnomyces yeasts.[12] It is anticonvulsant agent in valerian.[13] It uses to synthesize beta-methyl butyric acid by microbial oxidation via fungus. Caprylic acid is 8 carbon chain fatty acid (C8:0) and it is used commercially in the production of esters used in perfumery and also in manufacture of dyes. Caprylic acid is an antimicrobial pesticide used as a food contact surface sanitizer in commercial food handling establishment on dairy equipments breweries, wineries and beverage processing plants and as disinfectants in health care facilities. In addition Caprylic acid is used as an algaecide, bactericide and fungicide in nurseries, greenhouses, gardens centers. The acid chloride of caprylic acid is used in the synthesis of the perfluoroctanoic acid.[14] Capric acid (C10:0) is other name of Decanoic acid it is saturated fatty acid used in the manufacture of esters for artificial fruit flavors and perfumes, as an intermediate in chemical synthesis and industrially in the manufacture of perfumes, lubricants, greases, rubber dyes, plastics, food additives and pharmaceuticals.[15,16] Caproic acid (C6:0) also known hexanoic acid and is a medium chain triglycerides (MCT) which are widely used for parenteral nutrition in individuals requiring supplemental nutrition and are being more widely used in food drugs and cosmetics. it is fatty acid found naturally in various animals fats and oils, it is also one of the component of vanilla. The primary use of caproic acid is in the manufacture of its esters for artificial flavors and in the manufacture of hexyl derivatives such as hexylphenols,[17] Caprylic acid, Caproic acid along with Capric acid these total 15% in goat milk fat.

4. CONCLUSION

Extracted *Ficus elastica* leaves oil was analyzed for physicochemical properties and for fatty acids. It gave 19.28% yield. Its acid value 11.16 mg KOH/g, Saponification value 16.83 mg KOH/g, free fatty acid value 5.61%, peroxide value, 15 meq H_2O_2/g and refractive index 1.3970 respectively. Fatty acid profile was determined by GC-FID after esterification of the oil with methanol in the presence of boron trifluoruide. It contains lauric acid 3.36%, myristic acid, 3.12%, butyric acid 3.38%, isobutyric acid 6.50%, valeric acid 6.76%, isovaleric acid 23.59%, caprylic acid 5.41% and capric acid 20.28%, caproic acid 27.34%.keeping in view fatty acids profile and with the already published literature support we can say, that *Ficus elastica* oil is well suitable for cosmetic products.

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