Fatty Acids Constituents of Wood from *Schinus terebinthifolius* Raddi using GC Analysis

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Previously, *Schinus terebinthifolius* Raddi has been used in popular medicine as antipyretic, analgesic, and depurative. In the present study, the fatty acids constituents from wood of *S. terebinthifolius* were analyzed using GC. Standard fatty acids (C2-C25) were previously injected with the same condition used by GC. The total concentration of fatty acids presented in wood was 0.174%. Additionally, the total amount found in 100 g of sample wood was 0.094 g/100g sample. The major fatty acids detected in wood were; methyl ester of myristic acid (C14:0) 9.95%, methyl ester of 14-pentadecenooic acid (C15:1) 3.62%, methyl ester of pentadecanoic acid (C15:0) 3.66%, methyl ester of tridecanoic acid (C13:0) 6.19%, methyl ester of palmitic acid (C16:0) 5.17%, and methyl ester of erucic acid (C22:1, *cis*-13) 7.99%.

Key words: *Schinus terebinthifolius*, wood, fatty acids, GC analysis.

Schinus terebinthifolius Raddi belongs to family Anacardiaceae is a native plant from South America occurring in the Brazil (Corrêa, 1974) and was included in Brazilian Pharmacopeia (Brandão *et al.*, 2006). In the US it is popularly called Pink Pepper or Pink Berries and Aroeira or Cabuí, in Brazil (Pires *et al.*, 2004). *S. terebinthifolius* has long been used in traditional Brazilian medicine, especially to treat inflammatory and haemostatic diseases (Lima *et al.*, 2009). Several constituents have been identified like; phenols (Ceruks *et al.*, 2007), terpens (Lloyd *et al.*, 1977), tannins and flavonoids (Kassem *et al.*, 2004; Degáspari *et al.*, 2005; Hayashi *et al.*, 1989) and anthraquinones, xanthones and free steroids (Lima *et al.*, 2006). Schinol, biphenyl 4'-ethyl-4-methyl-2,2',6,6'-tetrahydroxy[1,1'-biphenyl]-4,4'-dicarboxylate obtained from stems, showed marked antifungal activity against *Paracoccidioides brasiliensis* (MIC=15.6µg/mL) (Johann *et al.*, 2010a) as well as quercetin and kaempferol were isolated from *S. terebinthifolius* and showed good Antifungal activity against the pathogenic fungus *P. brasiliensis*. Quercetin was previously exhibited activity against *Phytophthora megasperma* and *Cylindrocarpon destructans* (Báidez *et al.*, 2006). The aim of the present study was to identify the fatty acids composition of air-dried wood *Schinus terebinthifolius* Raddi using the GC analysis.

MATERIALS AND METHODS

Wood of *Schinus terebinthifolius* was collected from pruning process to the tree species at Al-Diriyah City located on the northwestern outskirts of the Saudi capital, Riyadh, Saudi Arabia, were provided by the laboratory of Botany and Microbiology Department, College of Science, King

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Saud University, during the month of August 2013. The plant was kindly identified and authenticated at the Department of Forestry and Wood Technology, Faculty of Agriculture, Alexandria University. Wood material was air-dried under shade at room temperature and then pulverized into powder to obtain a 40–60 mesh.

Fatty Acids Determination

Wood sample of 10 g was weighted out into a conical and 10 mL of concentrated HCl and boiled in water bath until all the sample has dissolved. The conical was allowed to cool and the fats were extracted by shaking with 30 mL of diethyl ether and the extract was blown into a weighed flask after allowing the layers to separate. The extraction was repeated three times more and distilled off the solvent then the fat was dried at 100 °C, cooled and weighed (Kirk and Sawyer 1991).

Methylation of Lipid

Sample of 50 mg of lipid was weighted in a tube, and 50 mL of methanolic sulfuric acid (1 mL concentrated sulfuric acid and 100 mL methanol) and 2 mL of benzene were added. The tube was well-closed and placed in water bath at 90 °C for an hour and half. The tube then was cooled, added 8 mL water and 5 mL petroleum ether. Subsequently, the tube was strongly-shacked and the ethereal layer was separated out and evaporated to dryness. Table 1 is showing the condition used for characterization of fatty acids by GC. Standard fatty acids (C2-C25) were previously injected with the same condition used by GC (Radwan, 1978).

RESULTS AND DISCUSSION

Fatty acids detected in wood of *Schinus terebinthifolius*

The total concentration of fatty acids presented in wood was 0.174%. Additionally, the total amount found in 100 g of sample wood was 0.094 g/100g sample, respectively.

The lipophilic components from wood are commonly composed mainly of fatty acids, and fatty acid esters. GC analyses of fatty acids of wood of *S. terebinthifolius* are presented in Table 2. The major fatty acids detected in wood (Figure 1) were; methyl ester of myristic acid (C14:0) 9.95%, methyl ester of 14-pentadecenooic acid (C15:1) 3.62%, methyl ester of pentadecanoic acid (C15:0) 3.66%, methyl ester of tridecanoic acid (C13:0) 6.19%, methyl ester of palmitic acid (C16:0) 5.17%, and methyl ester of erucic acid (C22:1, *cis*-13) 7.99%. The minor amounts were showed by methyl ester of heneicosanoic acid (C21:0) 1.33%, methyl ester of stearic acid (C18:0) 1.77% and methyl ester of hexadecenoic acid (C16:1) 1.62%.

The most frequent substances present in the family Anacardiaceae are triterpenes, phenolic lipids and biflavonoids and other classes of substances, such as phenols and cinnamic acid derivatives (Correia *et al.,* 2006) were also reported. Additionally, genus of *Schinus* revealed the presence of terpenoids and fatty acids in *S. terebinthifolius* and *S. molle* (Lloyd *et al.,* 1977, Terhune *et al.,* 1974). Other studies revealed that the ethanolic extract from the bark of

Table 1. GC condition for analysis of fatty acids

Device model	HP (Hewlett Packard) 6890 GC		
Column	HP-5 (5% diphenyl, 95% dimethyl polysiloxane), 30 m, 0.32 mm. ID, 0.25 µm film thickness.		
Carrier gas/gas flow	Nitrogen/1 mL/min.		
Detector/temperature	FID (Flame Ionization Detector)/250 °C.		
Injector temperature, Injection volume	220 °C, 2 µL in a splitless mode.		
Oven program	Initial Temp. 150 °C for 2 min.		
Ramps	Rate °C/min	Final Temp. °C	Hold time
1	10	200	-
2	5	250	9 min

Table 2. Fatty acid concentration in wood of *Schinus terebinthifolius*

Fatty acid (FA)	FA (g/100g lipid)	FA %	FA (g/100g sample)
Methyl ester of caprylic acid (C8:0)	0.0033	0.85	0.0018
Methyl ester of lauric acid (C12:0)	0.0026	0.65	0.0014
Methyl ester of tridecanoic acid (C13:0)	0.024	6.19	0.0132
Methyl ester of tetradecenoic acid (C14:1)	0.0033	0.84	0.0018
Methyl ester of myristic acid (C14:0)	0.039	9.95	0.0213
Methyl ester of 14-pentadecenooic acid (C15:1)	0.0142	3.62	0.0077
Methyl ester of pentadecanoic acid (C15:0)	0.0144	3.66	0.0078
Methyl ester of hexadecenoic acid (C16:1)	0.0064	1.62	0.0034
Methyl ester of palmitic acid (C16:0)	0.031	5.17	0.0111
Methyl ester of linolenic acid (C18:3, *cis*-9,12,15)	0.0022	0.58	0.00125
Methyl ester of stearic acid (C18:0)	0.0069	1.77	0.0038
Methyl ester of heneicosanoic acid (C21:0)	0.0052	1.33	0.0028
Methyl ester of erucic acid (C22:1, *cis*-13)	0.031	7.99	0.0171

S. terebinthifolius showed phenols, triterpenes and anthraquinones and the leaves showed the presence of phenols, flavones, flavonoids, xanthones, leucoanthocyanidins, flavanones and free steroids (Lima *et al.* 2006). The leaves and barks of *S. terebinthifolius* are rich in tannins and essential oils (Jorge and Markmann, 1996). Ethyl gallate, myricetrin, quercitrin, methyl gallate and myricetin were isolated from the ethyl acetate fraction of the ethanolic extract from leaves of *S. terebinthifolius* and these substances are responsible for the anti-free radical (Ceruks *et al.*, 2007).

The biologically active as well as the chemical composition of different extracts from different parts of *S. terebinthifolius* have been reviewed by (Carvalho *et al.*, 2013). More details about the biologically activity of *S. terebinthifolius* extracts of the lyophilized powder materials in the concentration of 80-100% were obtained by (Pereira, 2008). The results are unchanged. A similar result was found by (Moura, 2011) using extract of *S. terebinthifolius* using the hydroalcoholic extract in a gel formulation containing also parabens preservative system. The concentration of 5% of the powder of *S. terebenthifolius* was obtained by calculating the mean diameter of the halos of inhibition presented by five microorganisms in a concentration of 70%, as recommended (Farmacopéia Brasileira, 2011). On the other hand, the gel of *S. terebinthifolius* can be used for the treatment of bacterial vaginosis in non-pregnant women, showing an 84% cure rate (Amorim and Santos, 2003). However, the presence of alkyl phenols in preparations based on Aroeira materials can cause allergic reactions on the skin and mucous membranes, which seems to indicate that the use of these products requires caution (Lorenzi and Matos, 2008).

The antimicrobial action of *S. terebinthifolius* was also evaluated by Lima (2004), the aqueous extract was used in a concentration

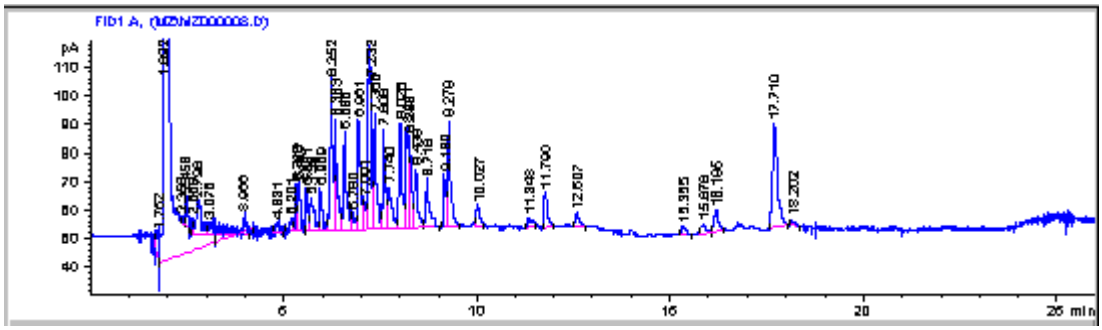

Fig. 1. GC chromatogram of the fatty acids from *Schinus terebinthifolius* wood

of 5000 mg/mL, where the zone of inhibition of *Staphylococcus aureus* was 11 mm, for *Escherichia coli* there was no growth, for *Pseudomonas aeruginosa* was 12 mm and for *Candida albicans* 14 mm. Alkaloids, fatty acids, flavonoids, isoflavonoids, tannins, coumarins, glucosides, terpenes, polyacethylenes and essential oils are originated from various metabolic routes (Ali *et al.,* 2013a; Ali *et al.,* 2013b; Abdel-Megeed *et al.,* 2013; Salem *et al.,* 2013). Tannins, saponins and polyphenol of *S. terebinthifolius* could be the major components that inhibited the growth of Jurkat cells (Woraratphoka *et al.,* 2012; Queires *et al.,* 2006).These substances are important in the defense mechanisms of the plant against fungi, bacteria, virus, parasites, insects, mollusks and superior animals (Calixto *et al.,* 2001).

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CONCLUSION

In the present study, the total concentrations of fatty acids presented in wood of *Schinus terebinthifolius* were 0.174%. The major fatty acids detected in wood were; methyl ester of myristic acid (C14:0) 9.95%, methyl ester of tridecanoic acid (C13:0) 6.19%, methyl ester of palmitic acid (C16:0) 5.17%, and methyl ester of erucic acid (C22:1, *cis*-13) 7.99%. Based on these results, we can conclude that the wood of *S. terebinthifolius* had moderate amounts of fatty acids as described by its fatty acids constituents.

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