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GC- MS Analysis of Kernel oil of *Mangifera indica*

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Abstract—Agro industrial waste are rich source of many important bioactive compounds so their potential use in food industry as natural antioxidant and antimicrobial agents may be good approach to replace synthetic preservatives.However it may also solve the environmental problems concurring disposal of waste and their by products.This may be a good source of profit for human.Mango kernels were dried ,powdered and extracted with hexane by using Soxhlet apparatus ,then subjected to GC-MS analysis by using Clarus GCMS-QP 2010 Ultra Gas chromatography. A huge amount of waste of mango kernels creates an environmental problem, so the objective of this study to utilize the mango kernels to make the environment clean and to increase the economic value of mango kernels.

Keywords-Kernel oil,GC-MS Spectroscopy,*Mangifera indica.*

Introduction

Mangifera indica is one of the most important tropical fruit of the world and it belongs the Anacardiaceae family.Mango is famous for its excellent flavor, delicious taste and nutritional value.Its popularity and importance can easily be realized by the fact that it is often referred as the king of fruits in the tropical world.Mango fruit is popular in both form in the fresh and the processed forms.About 80% of the fruit is consumed as fresh and about 20% is processed into chtney,puree,pickles and canned stuffs.In both the situation the mango kernels are discarded as waste.From environmental perspectives it is extremely important to utilize mango waste for safer environment.

Mango kernels represents about 20% of the whole fruit and 75% of stone (Ahmed*et al*., 2007).Mango kernel oil may be extracted from stone of mango fruit.It contains15% edible oil.Jafari *et al*., (2014) disclosed that mango kernel is a potential source of wide range of bioactive compound and antioxidants.

Depending on their variety mango seed kernels contain on a dry weight average 6% protein,11% fat,77% carbohydrate,2.0% crude fiber and 2.0 % ash.Mango seed kernels were shown to be a good source of polyphenol,phytosterols as compesterol, β-sitosterol and tocopherols.Nutritional and toxological studies of the

mango seed kernel fat is premising and a safe source of edible oil and was found to be nutritious and non –toxic so that it could be substituted for any solid fat without adverse effects.(Karnanithi *et al*., 2015).

Identification of different element of a mixture can be easy or difficult depending on the type of compound or sample involved.As we know Gas chromatography mass spectrometry 9GC-MS) is the best method to distinguish the bioactive constituents of long chain hydrocarbons, alcohols, acids, esters,alkaloids,steroids,amino acids and nitrogen compounds(Subhramanian Ramkrishanan 2011, Muthulakshmi *et al*., 2012, Yamuna devi *et al*., 2011,Gopal Krishnan and vadivel 2011).

In recent years,there has been an increasing interest in studies of mango due to valuable phenolic compound present in it which is beneficial for health.Not only bioactive compound found in fruits but also almost all the parts of the plants such as leaves ,barks,seed kernel are rich source of antioxidants and health promoting properties.(Wang *et al.*, 2010).

The kernel oil extracted from the seed of mango was very rich in oleic acid and stearic acid with high unsaponifiable content .So this oil has been used in cosmetic industry as an ingredient in soaps, shampoo,lotion because it is a very good source of phenolic compounds.(Naikau *et al* 2010, Kittiphoom*et al.*, 2013).

The mango seed oil is not utilized as mango fruit due to limited knowledge of the functional properties of the seed oil.In this study we characterized the properties of the seed oil extracted from kernels by using the GC-MS of oil to increase the use of kernel oil in both industryially and domestically and keep the environment clean.

Material and Method

Plant materials—The mango fruit kernels were collected from department of botany Ch.Charan Singh university Meerut.

Chemical and reagent—All the chemicals and reagent used in this study were of analytical grade.

Processing of Plant samples—The *Mangifera indica* were dicoated manually and kernels were removed from the seeds and than washed with distilled water and sun dried.The dried kernels were pulverized with ablender.

Extraction of oil from kernels—For the extraction of oil Soxhlet extraction method was used..The powerded sample 20 gm was inserted into the thimble of soxhlet extractor and n- hexane (300ml) was used as solvent and the approaches was assembled.The heating temperature was 65°C the apparatus was heated for 8 hours.The method was used in extraction was adopted by AOAC(1998).At the end of the extraction the thimble was removed while the remaining solvent is recharged into the round bottom flask.Finally the set up was then re-assembled and heated to recover the solvent from the oil.

Identification of the constituents of the oil using Gas Chromatography Mass Spectrometry (GC-MS)—For the analysis of kernel oil constituent GC-MS QP 2010 Ultra was used.A silica column5Sil MS(5% diphenyl/95% dimethyl poly siloxane (30 m length .25 mm ID and .25µm)Film thickness was used for the GC system and component were separated using Helium as carrier gas at a constant flow of 1ml/min.

Acquisition parameters

Column oven temp - 50°C

Injection Temp -260°C
Total Run Time -40 min
Pressure - 69.8K pa

Total flow -16.4 ml/min

Column flow -1.22ml/min

Linear Velocity -40.1 cm/sec

Equilibrium Time – 1 min

Purge flow -3.0ml/min

selit Ratio - 10
Scan speed -3333

Start m/z -40

End m/z -600

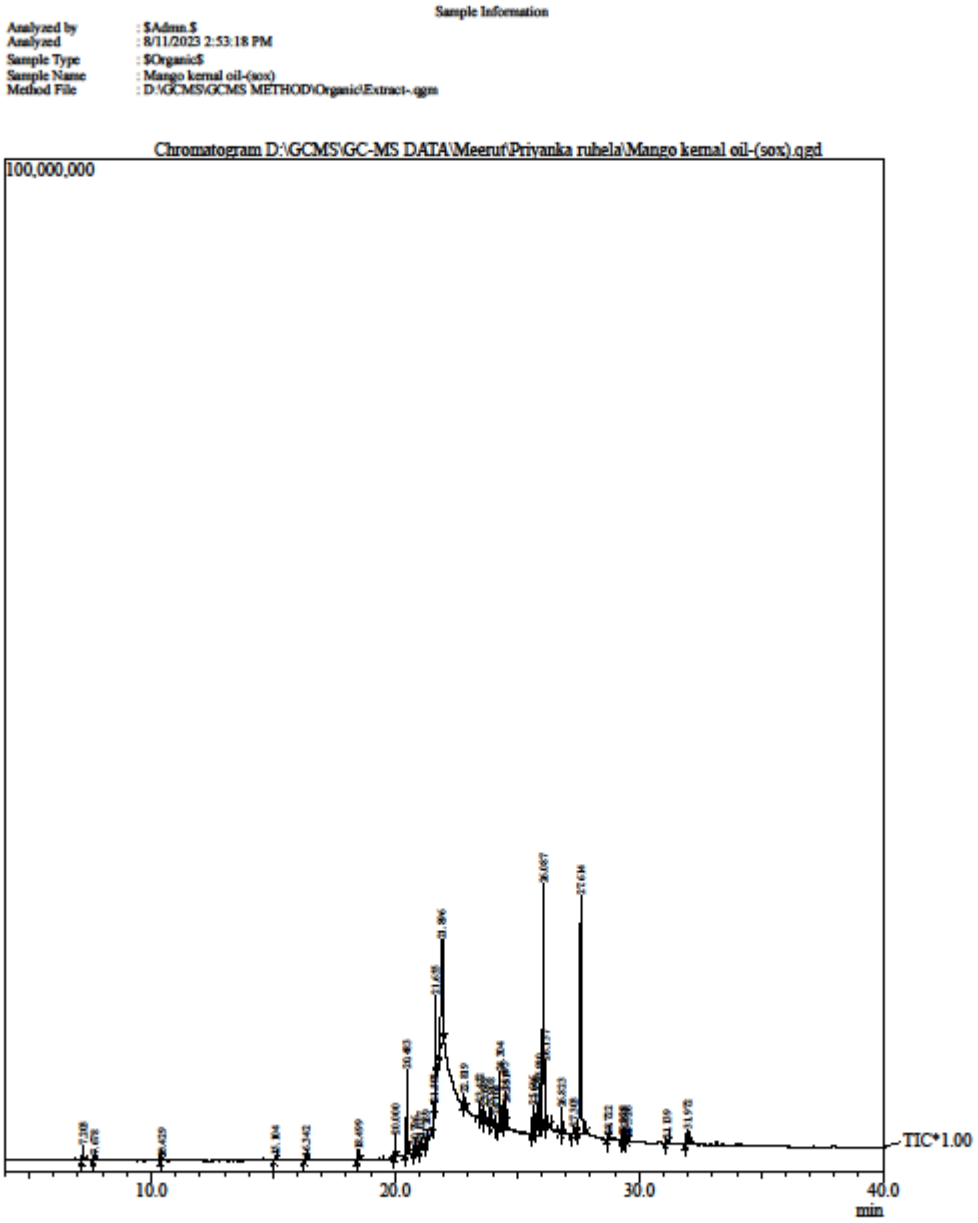
Identification of chemical compound of mango kernel oil

The bioactive compounds acquired from the mango kernel oil were perceived in view of the GC Gas chromatography retention time.The range of parts was concern with the information base of known parts range present in the WILEY 8 library and NIST (National institute standard and technology library 2008).Which has more than 62,000 pattern Quantitative judgment were made by relating the particular peak of region from the GC-MS.

Result and discussion

Table 1: The physio-Chemical properties of *Mangifera indica*kernel oil

Physiochemical indicators	Mango kernel oil
% oil yield	7.9
Appearance	Semi solid
Colur	Pale yellow



The physiochemical parameters of the mango kernel oil is present in table 1.The oil extracted from the mango kernel oil was semi solid at room temperature The percentage yield of the oil obtained from the kernel was 7.9%.The percentage yield of the oil is low but in agreement with those reported in literature (Amel and Eisa 2015).

Table 2 : Phytocomponents identified in the *Mangifera indica*kernel oil by GC-MS analysis

S. No	Compound Name	Molecular Formula	Retention Time	% composition	Mol.Wt.
1	Decane	$C_{10}H_{22}$	7.203	.58	142
2	Benzene Methylene	$C_{10}H_{14}$	7.678	.24	134
3	Dodecane	$C_{12}H_{26}$	10.429	.10	170
4	10-Undecanoic acid	$C_{14}H_{28}O_2Si$	15.104	.25	250
5	Dodecanoic acid	$C_{15}H_{32}O_2Si$	16.342	.18	272
6	Myristic acid	$C_{17}H_{36}O_2Si$	18.499	.46	300
7	Hexadecanoic acid	$C_{18}H_{36}O_2Si$	20.000	.95	284
8	Palmitic acid	$C_{19}H_{40}O_2Si$	20.483	4.17	328
9	13-Hexyloxacyclotridec 10-en-2-one	$C_{18}H_{32}O_2$	20.796	.36	280
10	9-Octadecanoic acid	$C_{19}H_{36}O_2$			296
11	Stearic acid methyl ester	$C_{19}H_{38}O_2$	21.269	.19	298
12	Linoleic acid ethyl ester	$C_{20}H_{36}O_2$	21.593	.50	308
13	Oleic acid	$C_{20}H38O2$	21.655	3.84	310
14	Ethyl stearate	$C_{20}H_{40}O_2$	21.896	14.86	312
15	Glycidyl palmitate	$C_{19}H_{36}O_3$	22.819	.79	258
16	9-Oct acanamide	$C_{18}H_{35}NO$	23.452	.54	281
17	Octacanamide	$C_{18}H_{37}NO$	23.649	.47	283
18	Oleoylchoride	$C_{18}H_{33}ClO$	23.908	.55	300
19	Octadecanoic acid	$C_{21}H_{42}O_4$	24.104	.48	358
20	Glycidyl oeate	$C_{21}H_{38}O_3$	24.304	3.56	338
21	Glycidyl pamitate	$C_{19}H_{36}O_3$	24.495	1.33	312
22	Phenol	$C_{21}H_{36}O$	24.551	.53	304
23	1-Cyclohexyldimethyl silyloxybutane	$C_{12}H_{26}OSi$	25.646	1.95	214
24	1,3,5 Trisilaydohexane	$C_3H_{12}Si_3$	25.832	2.40	132
25	Heptadeca-4,7 diene 1-yl	$C_{23}H_{36}O$	25.930	2.06	328
26	Heptadec 10-on 1-yl	$C_{23}H_{38}O$	26.087	24.23	330
27	3-Pentadecylphenol	$C_{21}H_{36}O$	26.157	5.11	304
28	Squalene	$C_{30}H_{50}$	26.823	1.12	410
29	Cardanol	$C_{28}H_{50}OSi$	27.303	.64	430
30	2-3 Penadec 8-en-1 yl	$C_{21}H_{34}O$	27.614	24.49	302
31	Octadecanoic acid	$C_{20}H_{40}O_3$	28.722	.18	328
32	Stigmast-5-en 3-ol oleate	$C_{47}H_{82}O_2$	29.328	.22	678
33	Heptadec-10-en-1-yl	$C_{23}H_{38}O$	29.395	.09	330
34	Vitamin E	$C_{29}H_{50}O_2$	29.526	.30	430
35	Stigmasterol	$C_{29}H_{48}O$	31.113	.39	412
36	Gamma sitosterol	$C_{29}H_{50}O$	31.972	1.56	414
				100.00	

The result showed that the mango kernel oil contain ns 36 compounds and the highest % of compound between them are: Palmitic acid 4.17%,(E)-9-Octadecanoic acid ethyl ester 3.84%,Octadecanoic acid 14.86%,Glycidyl oleate 3.56%,Z-3-(Heptadec 10-en-1 yl),Phenol 24.23%, 3 Pentadecylphenol 5.11%,(Z)-3(Pentadec 8-en-1-yl) Phenol 24.49%.

Mango kernel oil is a good source of phenolic compounds and fatty acids.The oil also contain tannins, Flavanoids, Phenolic compounds which found to be responsible for inhibiting the growth of microorganisms.They effect on the microorganism by inhibiting extracelluar microbial growth and by avoiding oxidative phosphorylation (Schiber *et al*., 2003)

The presence of Squaline 1.12% and sterol.39% show that it were unsaponifiable.The presence of Sterol shows that oil can be used as a natural antioxidant in different kind of food.

Stearic acid was the main saturated fatty acid while oleic acid was the major unsaturated fatty acids in all lipid class.Also phospholipid had a high amount of palmitic ,Linoleic acids(Magaldin *et al*., 2004).Mango seed kernel contain on a dry weight average 77% carbohydrate, 11%fat ,6.0%Protein, 2% crude fibre and 2.0% ash.according to mango variety.Mango seed kernels were shown to good source of $^{\beta}$Sitosterol, tocopherols and and phytosterols as copestrol.(Abdullah *et al* 2011).Presence of palmitic acid and stearic acids make this oil is fit for the production of candels,soap,,shaving cream,cosmetics and pharmaceuticals.The presence of linoleic acid indicate that the oil has the properties of anti-inflammatory,acne reductive,moisture retentive properties and skin lighting (Diezel,Schukz,Skand and Heise 1993,Letawa,Boone and Pierara 1998,Ando,Ryu,Hastimoto and Oka 1998.Linolic acid reduces the incidence of tumor and inhibits carcinogenesis.Hence this can be used in food,cosmetric and also good for biofuel.Oil is rich in Octadecanoic acid it is also called as ethyl stearate.It is used in hardening soaps,making cosmetics candle.The presence of cardanol show that it has the antioxidant properties that make them perfect for fighting against skin cancers,pancreatic cancer etc.

Conclusion

The main components of *Mangifera indica* seed kernel oil were hydrocarbons and fatty acids.The low percentage of free fatty acid shows that the extracted oil is in an undregraded state and it have low susceptibility to oxidative rancidity and deterioration.Mango kernel oil should be utilized in the food ,cosmetic,production of soaps shampoo,shaving cream and other cleaning agent.The mango kernel oil consist of many compounds such as phenolic and some acids that could be affect many microorganism.

Based on the above it could be concluded that the mango kernel oil could be used as a potential source for food ingredient ,antimicrobial compounds,cosmetic etc.This suggest that the mango seeds should be further utilized rather than discarded as waste.

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