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GC-MS analysis of bioactive phytochemicals of gum exudates of Mangifera indica. linn.

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***Abstract*---**The aim of this study was to verify the potential of Mangifera indica gum (MIG) as a bioactive agent. Plant gum was collected from the bark of Mangifera indica and was, purified and characterized with Fourier-transform infrared spectroscopy and gas chromatography (GC) analyses. Purified gum was tested for its antimicrobial, antioxidant, antidiabetic, and anti-inflammatory. IR and GC analyses of gum showed the presence of several types of bioactive components in Mangifera indica gum. The gum showed potent antibacterial activity against Gram-positive bacteria Staphylococcus aureus (63%) and Enterococcus faecalis (58%). The antioxidant activity of MOG was investigated by 2,2- diphenyl 2- picryl hydrazyl hydrate (DPPH) radical scavenging and the MIG shows good activity when compared with the standard ascorbic acid. The anti-inflammatory activity of the MIG was estimated by the bovine serum albumin denaturation (BSA)method and showed significant activity against the standard drug. The anti-diabetic activity of the MIG was determined by the dinitro salicylic acid (DNSA)method displayed significant anti-diabetic activity. These findings confirmed that MIG has a potential source for the formulation of new therapeutic drugs.

***Keywords*---**Mangifera indica gum, effective, pathogens, antibacterial activity.

Introduction

Natural polymers lately raise huge interest, this is mainly because they are easily available, cheap, and biocompatible also they are non-toxic, non-irritant, and have soothing effects [1]. Due to these features over semi-synthetic and synthetic one natural polymers are significantly used in pharmaceutical industries as a disintegrant, diluents, binders, and many other applications [2]. Demand for these substances is increasing, and new sources are being developed because of their geographical and environmental position, which have traditionally been a good source for such products among the African countries still, large quantities are imported from Europe to meet increasing demand [3]. Mangifera indica tree belongs to the genus Mangifera of the family Anacardiaceae [4]. In demotic medicine, the Mangifera indica tree has been used as a therapy against chronic dysentery, also in the prevention of cancer, scabies, asthma, and bacteria [5]. Mangifera indica gum resins spurt outside the mango tree's trunk by the act of the wind, fire, or any small injury on the trunk surface, that gum resin is collected and then purified [6].

The gums exude from trees and shrubs in tear-like, striated nodules or amorphous lumps, and then dry in the sun, forming hard, glassy, different-colored exudates [7]. Gum production increases under high temperatures and limited moisture, and yields can be increased by making incisions in the bark or stripping it from the tree or shrub. Exudate gums have been utilized in food applications for years, for emulsification, thickening, and stabilization [7]. Tree gum exudates are also used in non-food applications, such as pharmaceuticals, cosmetics, textiles, lithography, and minor forest products [8, 9]. The Negritos of the Philippines utilize the gum-resin of the tree mixed with coconut oil to apply directly to scabies and other parasitic diseases of the skin. The gum-resin is also used for curing aphthae and for healing sores caused by herpes and venereal diseases such as syphilis [10].

The gum consists mainly of terpenes but it also contains phenols and protein-carbohydrate mucilage [11]. The fruit gum-resin is a skin-irritant. The exudate is transparent, reddish-brown to black, and is slightly soluble in water [13]. The exudate contains 78% resin (terpenes and phenols) and 15% gum, in addition to tannic acid [14, 15] (Joel and Fahn, 1980b; http://www.rajans.com). Various parts of the plant are used as a dentifrice, antiseptic, astringent, diaphoretic, stomachic, vermifuge, tonic, laxative, and diuretic and to treat diarrhea, dysentery, anaemia, asthma, bronchitis, cough, hypertension, insomnia, rheumatism, toothache, leucorrhoea, haemorrhage and piles [16, 17, 18]. All parts are used to treat abscesses, broken horn, rabid dog or jackal bite, tumour, snakebite, stings, datura poisoning, heatstroke, miscarriage, anthrax, blisters, wounds in the mouth, tympanitis, colic, diarrhea, glossitis, indigestion, bacillosis, bloody dysentery, liver disorders, excessive urination, tetanus, and asthma [19 – 22]. Ripe mango fruit is considered to be invigorating and freshening [23]. The juice is a restorative tonic and is used in heatstroke [24]. The seeds are used in asthma and as an astringent [24]. Fumes from the burning leaves are inhaled for relief from hiccups and affections of the throat [25]. The bark is astringent, it is used in diphtheria and rheumatism, and it is believed to possess a tonic action on the mucus membrane [26, 27]. The gum is used in dressings for cracked feet and

for scabies [28-30]. It is also considered anti-syphilitic [31]. The kernels are converted into flour after soaking in water and eliminating the astringent principles [32]. Most parts of the tree are used medicinally and the bark also contains tannins, which are used for the purpose of dyeing [33].

Material and Methods

Collection and Purification of Gum

The MIG resin was collected from Mangifera indica trees (by injuring the trunk site). It was dried, ground, and passed through sieve no 80. Dried gum (85g) was stirred in distilled water (500ml) for 6-8 h at room temperature. The supernatant was obtained by centrifugation. The residue was washed with water and the washings were added to separate a supernatant. The procedure was repeated four more times. Finally, the supernatant was made up to 500 ml and treated with twice the volume of acetone by continuous stirring. The precipitated material was washed with distilled water and dried at 50-60°C under vacuum. The dried gum was pulverized and stored in tightly closed containers [34, 35].

Phytochemical analysis

The phytochemical component present in the Mangifera indica gum was determined as per the standard protocol [36].

FTIR Spectroscopy Analysis

The IR spectrum of the Mangifera indica gum was recorded in the range 4500cm^{-1}-400cm^{-1} on a Shimadzu FTIR–470 infra-red spectrophotometer by the KBr disc technique.

GC- MS analysis

GC-MS analysis was carried out on a GC Clarus 500 Perkin Elmer system comprising an AOC-20i autosampler and gas chromatograph interfaced to a mass spectrometer (GC-MS) employing the following conditions: column Elite-1 fused silica capillary column (30 x 0.25 mm ID x 1µM df, composed of 100% Dimethyl poly diloxane), operating in electron impact mode at 70 eV; helium (99.999%) was used as carrier gas at a constant flow of 1 mL/min and an injection volume of 0.5 µL was employed (split ratio of 10:1) injector temperature 250°C; ion-source temperature 280 °C.

Antimicrobial Activity

Bacterial strains such as Klebsiella pneumoniae (MTCC 432), Pseudomonas aeruginosa (MTCC 420) (Gram-negative bacteria), Staphylococcus aureus (MTCC 497), Bacillus cereus (MTCC 430), and Enterococcus faecalis (MTCC 439) (Gram-positive bacteria) and fungal strains such as Aspergillus niger (MTCC 1344), Aspergillus Oryzae (MTCC 262), Aspergillus flavus (MTCC 277), Candida albicans (MTCC 183) and Actinomyces (MTCC 160) are used for this study. All these strains are procured from the Microbial Type Culture Collection and Gene Bank

(MTCC), Chandigarh, India. These bacterial and fungal strains are subcultured frequently in nutrient agar and potato dextrose agar slants and stored at 4^0C for further studies [37, 38].

Antibacterial sensitivity assay of MIG is carried out by the disc diffusion method and the MIG is tested against the selected test bacterial strains. The test bacterial cultures are evenly spread over Mueller Hinton agar plates using a sterile cotton swab. The sterile discs are impregnated with MIG and placed in an inoculated agar. The plates are then incubated at 37^0C for 24 hours. After the incubation period is over, the plates are observed for the zone of inhibition (ZI) measured in millimeters (mm). From the results, the Activity index is calculated using the following formula.

$$Activity\ Index\ (AI) = \frac{\text{Inhibition Zone of the sample}}{\text{Inhibition Zone of the standard}}$$

The antifungal activity of the MIG is measured using the disc diffusion method. The fungal cultures to be tested are evenly spread over potato dextrose agar plates using a sterile cotton swab. Then the sterile paper impregnated with the MIG is placed on an agar plate. Inhibition zones are determined after incubation at 25^0C for 48 hours. After the incubation period is over, the plates are observed for the zone of inhibition (ZI) measured in millimeters (mm). From the results, the Activity Index is calculated using the following formula.

$$Activity\ Index\ (AI) = \frac{\text{Inhibition Zone of the sample}}{\text{Inhibition Zone of the sandard}}$$

Antioxidant Activity

Antioxidant activity of the MIG against stable 2,2- diphenyl 2- picryl hydrazyl hydrate (DPPH) is determined according to the method of Brand-William et al., (1995) with slight modification [39]. For DPPH assay the ascorbic acid is used as the reference standard. The ascorbic acid stock solution is prepared in distilled water (1 mg/ ml; w/v). A 60µM solution of DPPH in methanol is freshly prepared and a 3.9ml of this solution is mixed with 100µl of the test sample at various concentrations (6.25, 12.5, 25, 50, 100 µg/ml). The tubes are kept in the dark for 15 minutes at room temperature and the decrease in absorbance is measured at 515 nm. Control is prepared with DPPH solution only, without any extract or ascorbic acid. 95% methanol is used as blank. Scavenging activity is expressed as the percentage inhibition calculated using the following formula:

$$Percentage\ inhibition = \frac{(\text{Absorbance of Control at 0 min} - \text{Absorbance of test}) \times 100}{Absorbance\ of\ control\ at\ 15\ min}$$

Anti-Inflammatory Activity

The anti-inflammatory activity of the MIG is evaluated by the bovine serum albumin denaturation (BSA) method [40,41]. The reaction mixture (0.5 ml) consisted of 0.4 ml bovine serum albumin (3% aqueous solution) and varying concentrations of test sample (6.25,12.5,25,50,100 µg). The samples are

incubated at 37°C for 20 min and 2.5 ml phosphate-buffered saline (pH 6.3) is added to each tube and then heated at 80°C for 10 min. The absorbance is measured using a spectrophotometer at 660nm. The percentage inhibition of protein denaturation is calculated as follows:

Percentage of inhibition = [(Abs Control – Abs Sample) / Abs control)] x100

Anti-Diabetic Assay

The anti-diabetic activity of the MIG is determined using a modified assay that is described in the Worthington Enzyme Manual [42, 43]. A total 500µL of 0.02 M sodium phosphate buffer (pH 6.9 with 0.006 M NaCl) containing 0.5 mg/mL of α-amylase and different concentrations (in µg) of gum powder as inhibitor are pre-incubated at 37°C for 10 min. After the pre-incubation, 500 µL of a 1% starch solution in 0.02 M sodium phosphate buffer (pH 6.9) is added to each tube and incubated at room temperature for 5 mins. The reaction is stopped using 1mL of dinitro salicylic acid (DNSA) colour reagent. Then, the test tubes are incubated in a boiling water bath for 5 min and then cooled to room temperature. Make up the volume of the reaction mixture to 10mL by adding distilled water, and the absorbance is measured at 540 nm using a UV-Visible light spectrophotometer. The absorbance readings are compared with the control and blank that contained buffer instead of sample extract.

$$\%\ of\ Inhibition = \frac{(\mathrm{B} - \mathrm{A}) * 100}{(B - C)}$$

C- Absorbance of the Control with starch and without alpha-amylase
B- Absorbance of the Control with starch and alpha-amylase
A-Absorbance of the Test.

Result and Discussion

Phytochemical analysis

The phytochemical analysis of the Mangifera indica gum in water shows the secondary metabolites such as carbohydrates, alkaloids, phenols, phytosterols, xanthoproteins, carboxylic acids, saponins, tannins, etc is given in Table 1.

Table 1 Phytochemical analysis of MIG (G3)

Sl. No	Tests	MIG
1	Carbohydrates	+
2	Proteins	_
3	Alkaloids	+
4	Phenols	+
5	Flavonoids	_
6	Phytosterols	+
7	Quinones	-
8	Xanthoproteins	+

9	Coumarins	_
10	Carboxylic acids	+
11	Saponins	+
12	Tannins	+

FTIR Spectroscopy Analysis

The Fourier transform infrared spectroscopy (FTIR) analysis confirmed the functional group found in the Mangifera indica gum. FTIR Spectra of Mangifera indica Gum (G_3) displayed in Figure 1 shows a broad and intense peak at 3417 cm^{-1} was obtained due to hydrogen-bonded –OH stretching of alcohols and phenols. The peak at 2924 cm^{-1} indicates the C-H stretching which is attributed to the presence of alkenes. An intense and narrow peak at 1627 cm^{-1} and 1728 cm^{-1} represents N-H bending and C=O stretching of amide linkages; this is expected to be due to the proteinaceous content of the Mangifera indica gum i.e., amino acids present in gum like alanine, asparagine, glycine, etc. and sugars present viz. fructose, galactose, etc. respectively. A minor peak at 1041 cm^{-1} depicts the C-O bonding of alcohol.

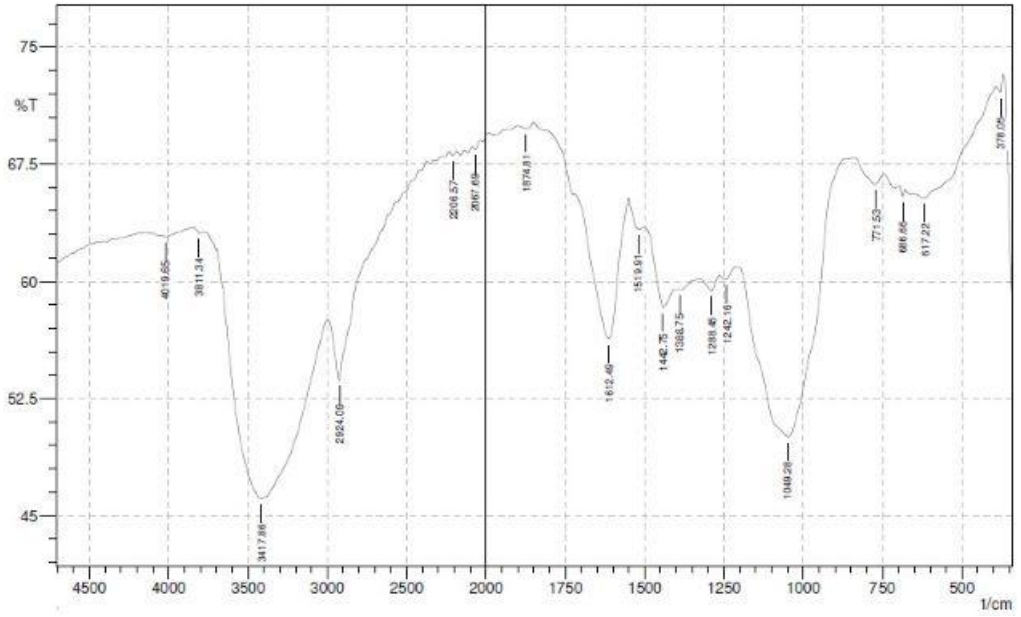


Figure 1 FTIR Spectrum of MIG (G_3)

GC- MS analysis

The GC-MS spectrum of the Mangifera indica gum reveals the presence of ten constituents. The constituents of MIG are presented in Table 2 and the total mass spectrum of MIG is depicted in Figure 2. The major constituents present are 2,6,10-Trimethyl Dodecane, 1-Dodecanol, Eicosane, 1,2-Benzene dicarboxylic acid diethyl ester, Arabinitol, 3-Trimethyl Cholest-5-ene, 3-Thiophene Carboxylic

acid, 12-Hydroxy Stearic acid, Pregnane-3,11-dione and, 9,12-Octadecadienoic acid.

Table 2 The Constituents of MIG (G3)

S. No	Retention Time	Compound Name	Mol. Formula	Mol. Wt.	Area %
1	14.289	2,6,10-Trimethyl Dodecane	$C_{15}H_{32}$	212	10.7
2	38.60	1-Dodecanol	$C_{12}H_{26}O$	186	22.53
3	38.747	Eicosane	$C_{20}H_{42}$	282	22.23
4	38.765	1,2-Benzene dicarboxylic acid diethyl ester	$C_{12}H_{14}O_4$	222	19.73
5	38.855	Arabinitol	$C_{15}H_{22}O_{10}$	362	16.41
6	38.860	3-Trimethyl Cholest-5-ene	$C_{30}H_{54}$	458	18.62
7	38.985	3-Thiophene Carboxylic acid	$C_{21}H_{22}O_6S_3$	466	23.05
8	38.995	12-Hydroxy Stearic acid	$C_{18}H_{36}O_3$	300	20.05
9	39.015	Pregnane-3,11-dione	$C_{21}H_{30}O_2$	318	15.46
10	39.025	9,12-Octadecadienoic acid	$C_{27}H_{54}O_4$	313	19.43

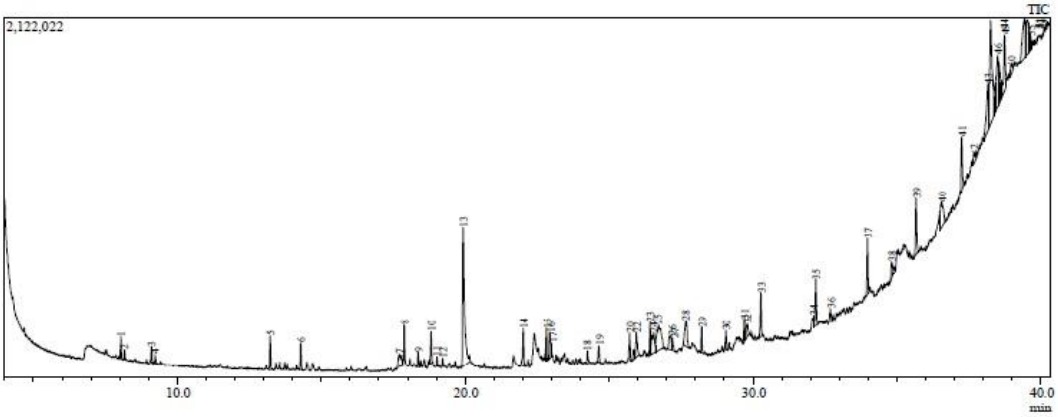


Figure 2 Chromatogram of MIG (G_3)

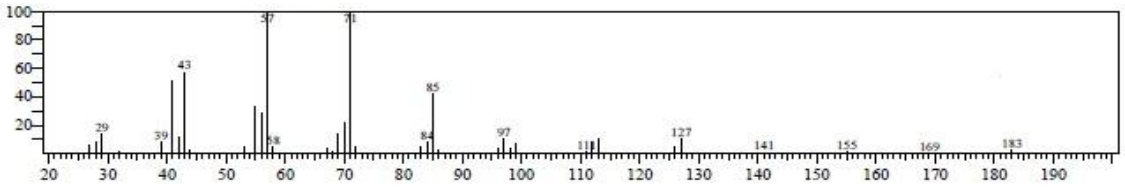


Figure 3 EI mass spectrum of 2,6,10-Trimethyl Dodecane

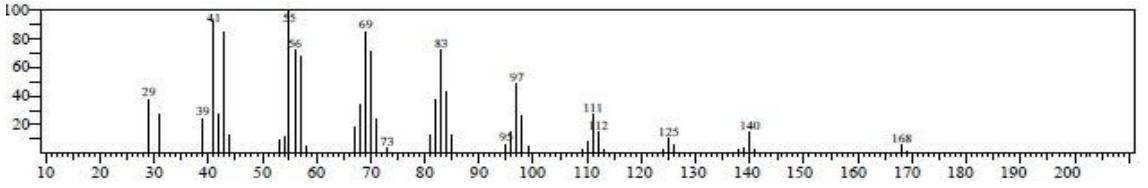


Figure 4 EI mass spectrum of 1-Dodecanol

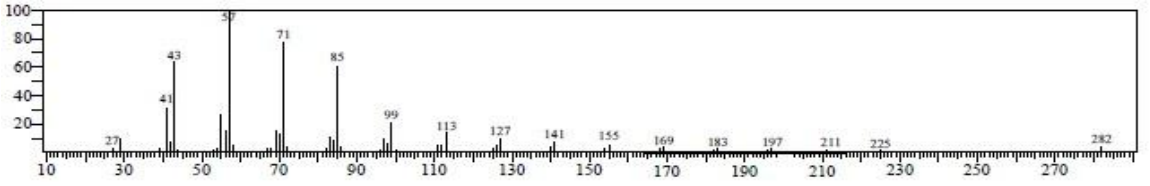


Figure 5 EI mass spectrum of Eicosane

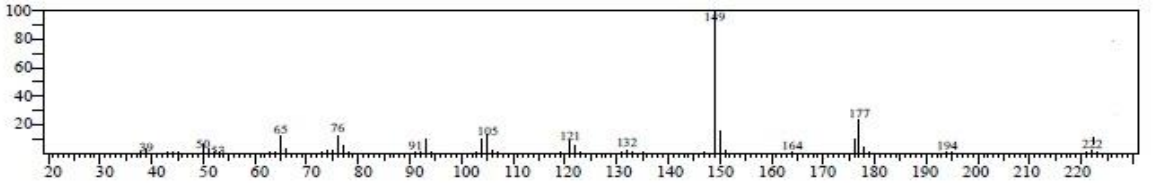


Figure 6 EI mass spectrum of 1,2-Benzene dicarboxylic acid diethyl ester

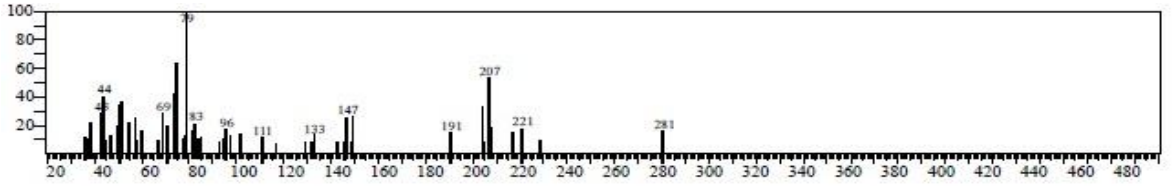


Figure 7 EI mass spectrum of Arabinitol

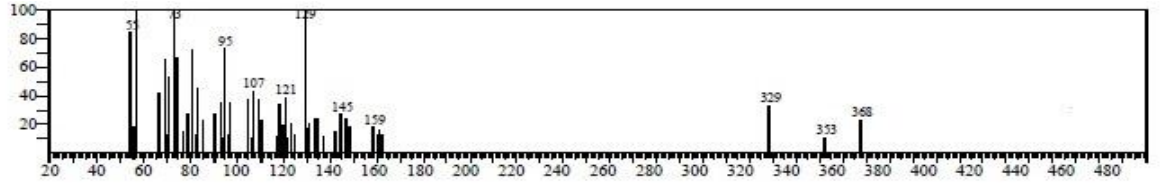


Figure 8 EI mass spectrum of 3-Trimethyl Cholest-5-ene

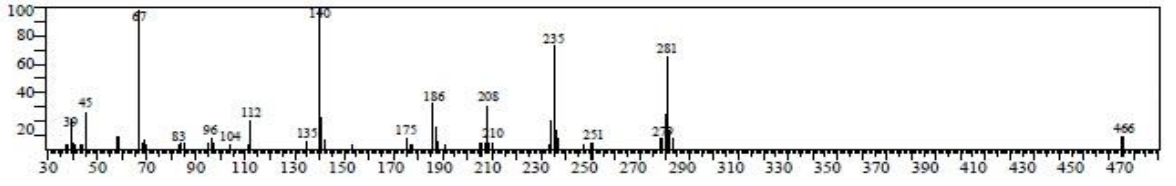


Figure 9 EI mass spectrum of 3-Thiophene Carboxylic acid

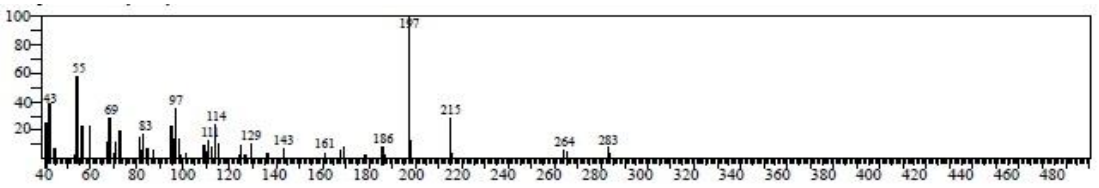


Figure 10 EI mass spectrum of 12-Hydroxy Stearic acid

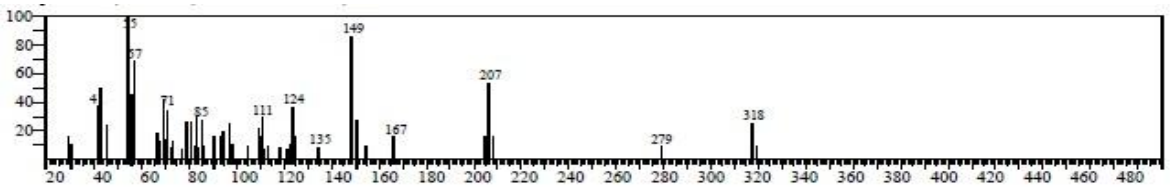


Figure 11 EI mass spectrum of Pregnane-3,11-dione

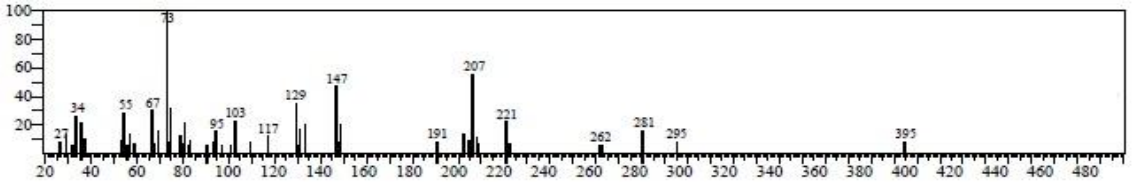
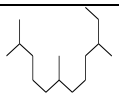
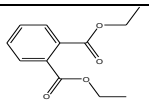
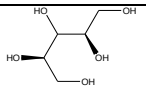
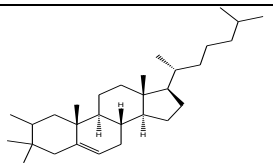
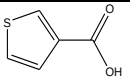
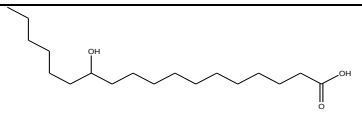
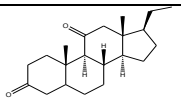
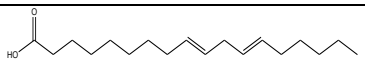


Figure 12 EI mass spectrum of 9,12-Octadecadienoic acid

The EI mass spectrum of 2,6,10-Trimethyl Dodecane is shown in Figure 3. The peak at m/z 212, which appeared at R.T. 14.289 in the total mass chromatogram, corresponds to $C_{15}H_{32}$. The EI mass spectrum of 1-Dodecanol is displayed in Figure 4. The peak at m/z 186 with R.T. 38.6 is due to $C_{12}H_{26}O$. Figure 5 shows the EI mass spectrum of Eicosane. The peak m/z 282 with R.T. 38.747 was detected in the spectrum. It corresponds to $C_{20}H_{42}$. Figure 6 displayed the EI mass spectrum of 1,2-Benzene dicarboxylic acid diethyl ester. The peak at m/z 222 with R. T. 38.765 attributes to $C_{12}H_{14}O_4$. The EI mass spectrum of Arabinitol is shown in Figure 7. The peak at m/z 362, which appeared at R.T. 38.855 in the total mass chromatogram, corresponds to $C_{15}H_{22}O_{10}$. The EI mass spectrum of 3-Trimethyl Cholest-5-ene is displayed in Figure 8. The peak at m/z 458 with R.T. 38.86 is due to $C_{30}H_{54}$. Figure 9 shows the EI mass spectrum of 3-Thiophene Carboxylic acid. The peak m/z 466 with R.T. 38.985 was detected in the spectrum. It corresponds to $C_{21}H_{22}O_6S_3$. Figure 10 displayed the EI mass spectrum of 12-Hydroxy Stearic acid. The peak at m/z 300 with R. T. 38.995 attributes to $C_{18}H_{36}O_3$. The EI mass spectrum of Pregnane-3,11-dione is shown in Figure 11. The peak at m/z 318, which appeared at R.T. 33.015 in the total mass chromatogram, corresponds to $C_{21}H_{30}O_2$. The EI mass spectrum of 9,12-Octadecadienoic acid is shown in Figure 12. The peak at m/z 313, which appeared at R.T. 33.025 in the total mass chromatogram, corresponds to $C_{27}H_{54}O_4$.

Table 3 Applications of Bioactive components of MIG

Sl. No	Compound Name	Structure of Compound	Applications	References
1.	2,6,10-Trimethyl Dodecane		Antibacterial, Anti-oxidant	44, 45
2.	1-Dodecanol		used to treat diabetes and malaria	46, 47
3.	Eicosane		Antibacterial activity	48
4.	1,2-Benzene dicarboxylic acid diethyl ester		Bronchitis, colds, and inflammation	49
5.	Arabinitol		Mouth sores, tooth pain, cancer, diabetes, asthma, gastric disorders, and lupus	50
6.	3-Trimethyl Cholest-5-ene		Diarrhoea, ulcers, diabetes, dysentery, cough, gall bladder and kidney diseases,	51,52
7.	3-Thiophene Carboxylic acid		Anti-inflammatory	53
8.	12-Hydroxy Stearic acid		Antimicrobial activity	54
9.	Pregnane-3,11-dione		Asthma, bronchitis, cough, and throat problems	55,56
10.	9,12-Octadecadienoic acid		Hemorrhages, wounds, diseases in throat and hiccups, burns, and scalds	57,58

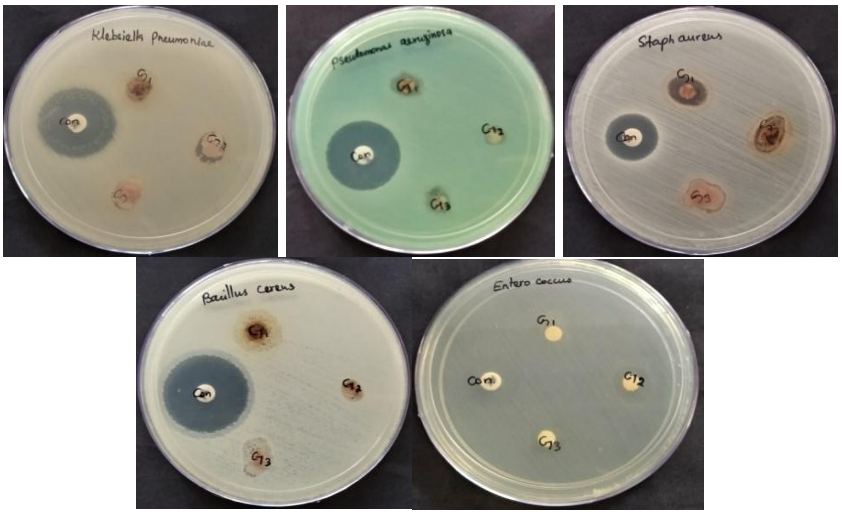
Antibacterial activity

The bioassay result for antibacterial activity of the MIG is presented in table 3. The MIG exhibits a varying degree of antibacterial activities against the test organisms. The MIG shows the highest activity with the zone of inhibition 12 mm and 11 mm against Staphylococcus aureus and Enterococcus faecalis. The results are also expressed using the Activity Index in Table 3. The antibacterial activities of MIG against the studied pathogenic strains are shown in Figure 13.

Table 3 Antibacterial activity of MIG (G_3)

Name of the Organisms	**Zone of the Inhibition (mm)** G_3		**Control (Amikacin) mm**
	ZI (mm)	**AI (mm)**	
Klebsiella pneumoniae	10	0.38	26
Pseudomonas aeruginosa	11	0.44	25
Staphylococcus aureus	12	0.63	19
Bacillus cereus	-	-	29
Enterococcus faecalis	11	0.58	19

ZI - Zone of Inhibition AI – Activity Index



Con – Control G_3 – Mangifera indica gum

Figure 13 Antibacterial activity of MIG (G_3) against antibacterial strains

Antifungal Activity

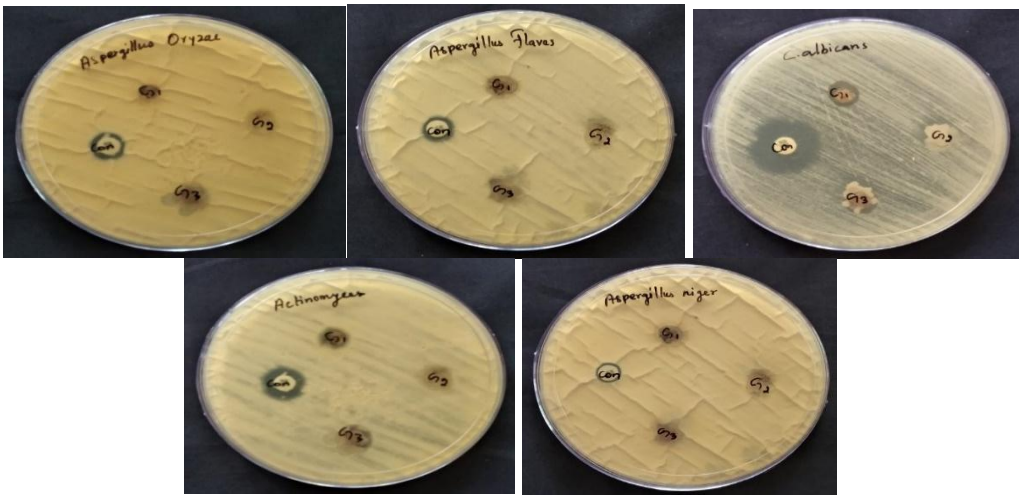
Table 4 Antifungal activity of MIG (G3)

Name of the Organisms	**Zone of the Inhibition (mm)** G_3		**Control (Nystatin) mm**
	ZI (mm)	**AI (mm)**	

Aspergillus niger	9	0.75	12
Aspergillus Oryzae	11	0.79	14
Aspergillus flavus	10	0.91	11
Candida albicans	12	0.5	24
Actnomyces	12	0.8	15

ZI - Zone of Inhibition AI – Activity Index

The antifungal activity of the MIG is presented in Table 3. The MIG exhibits a varying degree of antifungal activities against the test organisms. The MIG shows the highest activity against all the fungal strains used in this study. The results are also expressed using the Activity Index in Table 4. The antibacterial activities of MIG against the studied pathogenic fungal strains are shown in Figure 14.



Con – Control G_3 – Moringa gum

Figure 14 Antifungal activity of MIG (G_3) against antibacterial strains

Antioxidant Activity

The anti-oxidant effect of moringa oleifera gum by using DPPH radicals. Different concentrations (3, 6.25, 12.5, 25, 50µg/ml) of MIG and Ascorbic acid is used as a standard in this study. Table 5 shows the DPPH radical scavenging activity of MIG. In this assay, the maximum inhibition is noted at 50 µg/ml and minimum inhibition is noted at 3µg/ml of MIG and standard ascorbic acid. In Figure 15 A graph is plotted between the percentage of inhibition and concentration. In the graph, the percentage of inhibition increases when the concentration of MIG and standard increases. The IC_{50} value for Mangifera indica is 12.96 and for ascorbic acid is 21.79. The MIG shows better antioxidant activity than ascorbic acid.

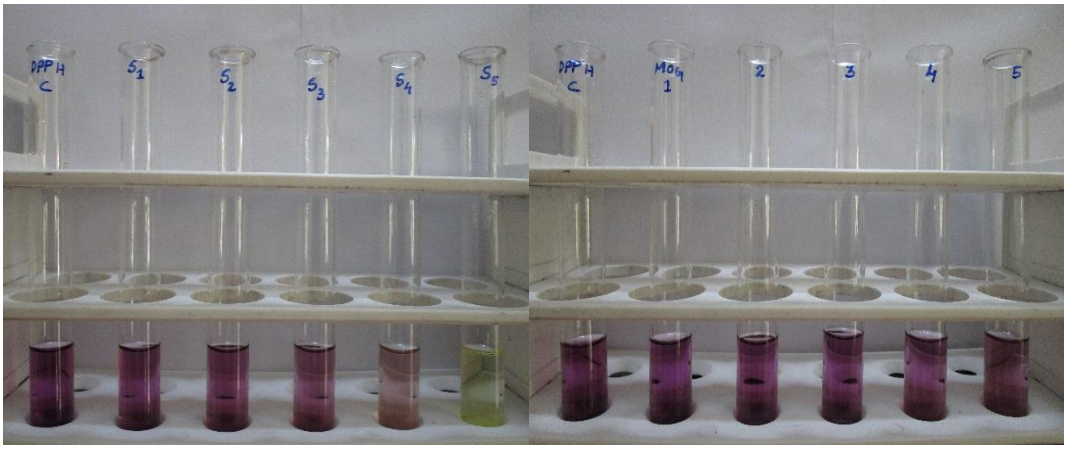


Figure 4 Antioxidant activity of Standard and MIG

Table 4 Antioxidant activity of MIG

Concentration (µg)	ASCORBIC ACID (STANDARD)		MIG	
	Optical Density at 515nm	Percentage of Inhibition	Optical Density at 515nm	Percentage of Inhibition
3	0.737	8.25	0.682	10.39
6.25	0.665	17.46	0.604	27.97
12.5	0.519	35.95	0.466	40.56
25	0.279	66.45	0.249	70.64
50	0.024	98.55	0.013	99.44
IC50	**21.79**		**12.96**	

Anti-Inflammatory Activity

The mechanism of the anti-inflammatory activity investigates the ability of Moringa oleifera gum (MIG) by the inhibition of protein denaturation assay. The inhibitory effect of the sample was shown in Table 5. The maximum inhibition of protein denaturation for the sample and standard (Diclofenac) at 100 µg/mL is found to be 45.68% and 48.65% respectively. The IC50 value for the sample and the standard is observed as 106.6 and 146.6 respectively. From the above results, it is identified that the sample is having less protein denaturation.

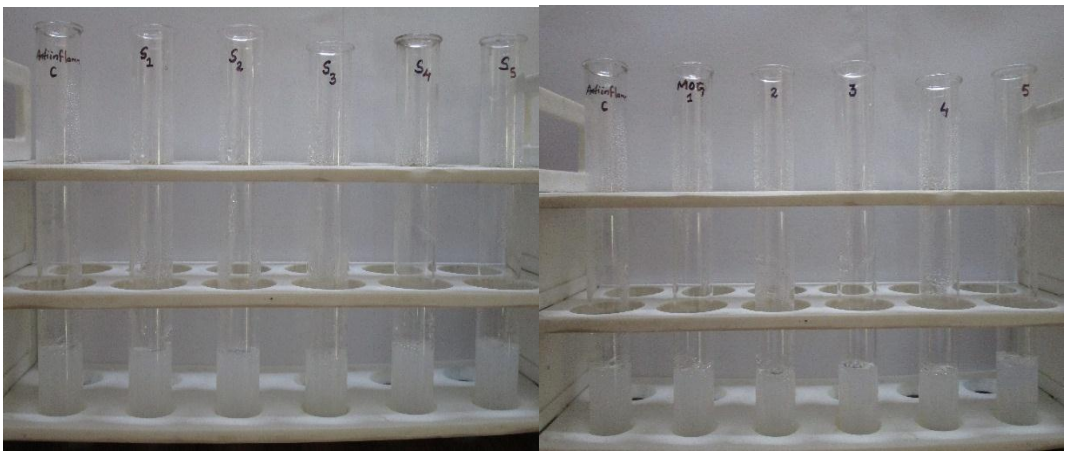


Figure 5 Plot of Anti-Inflammatory activity of Standard and MOG

Table 5 Anti-Inflammatory activity of MOG

Concentration (µg)	Diclofenac (Standard)		MOG	
	Optical Density at 660 nm	Percentage of Inhibition	Optical Density at 660 nm	Percentage of Inhibition
6.25	0.579	0.17	0.656	10.5
12.5	0.574	1.05	0.654	10.77
25	0.500	13.9	0.592	15.65
50	0.444	23.44	0.517	25.62
100	0.315	45.68	0.351	48.65
IC50	**106.6**		**146.6**	

Anti-diabetic Activity

The in vitro anti-diabetic activities of various concentrations (6.25, 12.5, 25, 50, 100 µg/ml) of Moringa gum with the standard drug acarbose by an inhibitory activity of α-amylase enzymes. The percentage of inhibition of α-amylase is increased in higher concentrations (100 µg/ml) of moringa oleifera gum. The inhibition of moringa gum and acarbose of α-amylase is 60.5% at 12.5µg, 75.64% at 25µg, 85.75% at 50µg and 97.23µg% at 100µg/ml and 27.31% at 6.25µg, 55.09% at 12.5µg, 70.37% at 25µg, 82.87% at 50µg and 87.03µg% at 100µg/ml and the IC50 values are 10.23 for moringa gum and 61.8 for acarbose. The anti-diabetic activity of *Moringa oleifera* gum is shown in Table. 6.

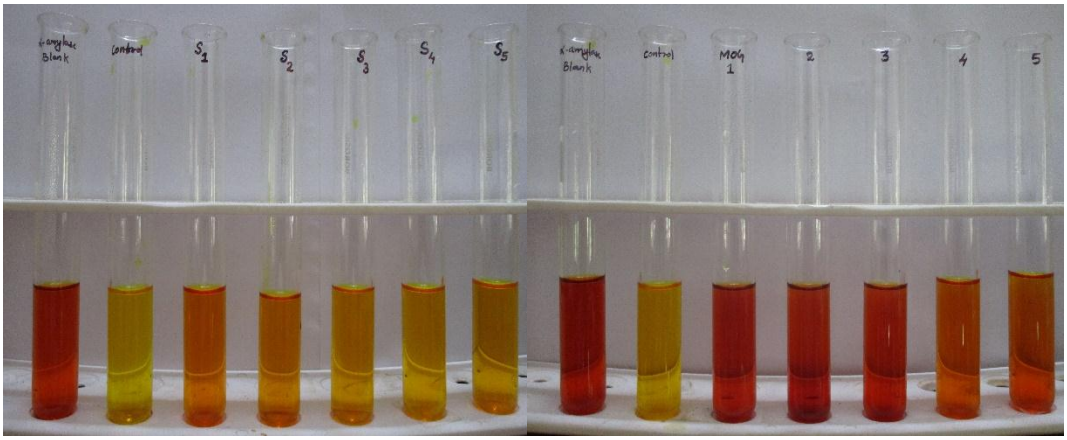


Figure 6 Anti-diabetic activity of Standard and MOG

Table 6 Anti-diabetic activity of MOG

Concentration (µg)	Acarbose (Standard)		MOG	
	Optical Density at 540 nm	Percentage of Inhibition	Optical Density at 540 nm	Percentage of Inhibition
6.25	0.222	27.31	1.470	-
12.5	0.162	55.09	0.145	60.5
25	0.129	70.37	0.105	75.64
50	0.102	82.87	0.095	85.75
100	0.093	87.03	0.056	97.23
IC50	**10.23**		**61.8**	

Conclusion

MIG has screened for secondary metabolites and this indicates the presence of Carbohydrates, Alkaloids, Phenols, Phytosterols, Xanthoproteins, Carboxylic acids, Saponins, and Tannins. The Fourier transform infrared spectroscopy (FTIR) analysis has studied the functional biomolecules present in the gum. GCMS analysis shows the presence of important compounds like 2,6,10-Trimethyl Dodecane, 1-Dodecanol, Eicosane, 1,2-Benzene dicarboxylic acid diethyl ester, Arabinitol, 3-Trimethyl Cholest-5-ene, 3-Thiophene Carboxylic acid, 12-Hydroxy Stearic acid, Pregnane-3,11-dione and, 9,12-Octadecadienoic acid. The gum showed potent antibacterial activity against Gram-positive bacteria Staphylococcus aureus (63%) and Enterococcus faecalis (58%). It is concluded that this study would lead to the establishment of some valuable compound that has to be used to formulate new, different, and more potent antibacterial drugs of natural origin.

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