Faculty of Natural and Applied Sciences Journal of Scientific Innovations
Print ISSN: 2814-0877 e-ISSN: 2814-0923
www.fnasjournals.com
Volume 3; Issue 2; March 2022; Page No. 28-34.

SPECTROSCOPIC CHARACTERIZATION OF D-GLUCITOL FROM *MANGIFERA INDICA* ROOT

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Abstract
Mangifera indica is a plant of the family Rutaceae used for treating different ailments such as malaria, sickle cell anaemia, tuberculosis, paralysis and intestinal disorder due to the presence of some bioactive constituents... The goal of this research was to discover and characterise some of the active components found in the plant's stem bark. Between October 2018 and February 2019, the compounds were isolated and characterised at the Strathclyde Institute of Pharmacy and Biomedical Sciences (SIPBS), University of Strathclyde, Glasgow, United Kingdom. To get the crude extract, the root bark powder was exposed to Soxhlet extraction with hexane, which was fractionated on column using hexane and ethyl acetate in increasing ratios. On spectral examination, white crystals were found (IR, 1H-NMR, 13C-NMR, 2D-NMR)..

Keywords: Spectroscopic Characterization, Mangifera Indica, D-Glucitol, Spectroscopy

Introduction

Mangifera indica is a member of the Mangifera genus of the Anacardiaceae family, also known as the mango family. Several edible fruit-bearing plants belong to the genus Mangifera. Mango trees (M.indica) make up the majority of the fruit plants that are usually known as mangos (Anacardiaceae). Other edible mangifera species are referred to as wild mangos since their fruit is of poorer quality. The flowering plant family Anacardiaceae has roughly 30 species of tropical fruiting trees in the genus Mangifera, with M.indica being the most prevalent (Kalita, 2014). Mangifera indica is a broad-canopy evergreen tree that grows to a height of 8-20 metres and has thick brown-gray bark that is superficially broken (Kalita, 2014). The leaves are 10-15cm long and come in a variety of sizes. The length of the leaf petiole varies from 1 to 8 cm. Mangifera indica leaves come in a variety of forms (Lanceolate, ovate-cancelate, linear-oblong, roundish-oblory, oval and oblong). Some mango types have green, red, and yellow leaves, and the top leaf surfaces are usually lustrous (Madan et al., 2014). The flowering season lasts from January to April, and the majority of the blooms are subsessile and fragrant.

Mangifera indica produces drupes of various sizes, shapes, and colours. M.indica trees grow into an evergreen dome-shaped canopy that branches 0.6-2m (2-6.5ft) above the ground. Syphilis, anaemia, scabies, diabetes, diarrhoea, stomach problems, asthma, cough, pulmonary haemorrhages, dysentery, inflammation, fever, ulcer, and leucorrhea are among the conditions for which the plant is utilised. Multiple drug resistance has emerged in both human and animal diseases in recent years as a result of indiscriminate antibiotic usage. Plant medications are biodegradable, safe, and have fewer adverse effects, which emphasises the need to screen medicinal plants for new bioactive chemicals (Stern et al., 2003). Plants have traditionally been used to cure human ailments since they are thought to be safer than manufactured pharmaceuticals. As a result, medicinal plants have become increasingly important as alternative sources of effective drugs. This study aimed at isolating and characterizing compound(s) which could be responsible for the claimed ethnomedicinal activities of the plant. Again, the study also focused on elucidating the structure of isolated compound using available spectroscopic techniques.

Materials and methods

Mangifera indica root was gathered in Bunu Tai, Tai LGA, Rivers State, and identified at Ignatius Ajuru University of Education, Port Harcourt's Department of Agricultural Science. The voucher specimen number IAU/2019/MI-12

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Nna, P.J.(2022.Spectroscopic characterization of d-glucitol from *mangifera indica* root. *FNAS Journal of Scientific Innovations, 3*(2), 28-34

was given to the sample, and it was placed in their herbarium. Using a mortar and gun, the sample was air dried and crushed to powder**.**

Extraction

The pulverised Mangifera indica root bark (1 kg) was extracted for 72 hours using a soxhlet equipment and hexane. The extract was rotary evaporated to dryness at 40 degrees Celsius**.**

Isolation and characterisation

The crude hexane extract (10 g) was diluted in 30 mL hexane and absorbed on silica gel (8 g), after which the solvent was allowed to evaporate entirely to create a slury. The slury was put to a gravity column as a concentrated band and eluted gradient-wise, commencing with hexane (200 mL), then mixtures of hexane; ethyl acetate 90:10, 85:15, and 80:20 (200 mL each) (Nande & Igoli 2017). Fractions were collected in 20mL vials and left to dry at room temperature until the solvents evaporated. Following TLC analysis, similar column fractions were merged (Hostellmon et al., 1998). Hexane eluted fractions 8-10,29,30, and 31; when burned with strong sulphuric acid, ethyl acetate produced a similar TLC profile with single greenish spots, RF values 0.63. Fractions 11,12,13, and 14 eluted similarly with hexane; ethyl acetate produced a similar TLC profile (brown spots when burned), with RF values of 0.61. Compounds 1 and 2, designated NPJS-29 and NPJS-13, were recrystallized in ethyl acetate from the combined fractions 29-31 and 11-14. The compounds underwent spectroscopic study (NMR spectroscopy and mass spectrometry), melting point determination, and a bioassay to test their biological activity against infections**.**

Characterisation of NPJS 29 as D-Glucitol

Fraction NPJS 29 on drying yielded a white solid with melting point 108-111^{0}C. ^{1}H-NMR spectrum clearly showed six methoxy protons at 3.82 each.The methylene group (CH_2) from the hydroxyl group appeared at δ 6.02. Proton with chemical shift at δ 6.02 and 6.03 were notable as aromatic protons (Yamada and Saier, 1987). Other protons chemical shifts were observed at δ 2.98 - 4.91. The ^{13}C-NMR spectrum showed 14 carbon atoms with a hetero-oxygen in the ring B which is a characteristic of a sugar moiety. However, five of these carbon atoms were hydroxylated and thus shifted downfield at 72.6, 81.4, 72.6, 69.9 and 158.2 assigned to C-2', C-3', C-4', C-6' and C-3, respectively. The ^{13}C-NMR spectrum also showed peaks at δ162.4, 106.8, 158.2, 94.0, 161.1 and 95.6 assigned to aromatic carbon atoms: C-1, C-2, C-3, C-4, C-5 and C-6, respectively. The chemical shift at δc 54.9 and 60.5 were assigned to the methoxy carbon atoms. Based on the the spectroscopic data and comparison with literature report (Mahling &Schmidt, 1993), fraction NPJS 29 was identified and characterized as D-Glucitol.

Table 1: ^{1}HNMR and ^{13}C NMR Chemical Shifts for NPJS 29

Spectroscopic technique	Data
Mp	108-110^{0}C
Rf [Hex:EAC(7:3)]	0.56
^{1}HNMR(DMSO)	*δ* 6.03, 6.02, 4.71, 2.98, 3.40, 3.58, 3.48, 3.34, 3.68, 3.7 ppm
^{13}C NMR(DMSO)	*δ* 162.4, 106.8, 158.2, 94.0, 161.1, 95.6, 104.0, 72.6, 81.4, 72.6, 81.4, 69.9, 60.5, 54.9 ppm

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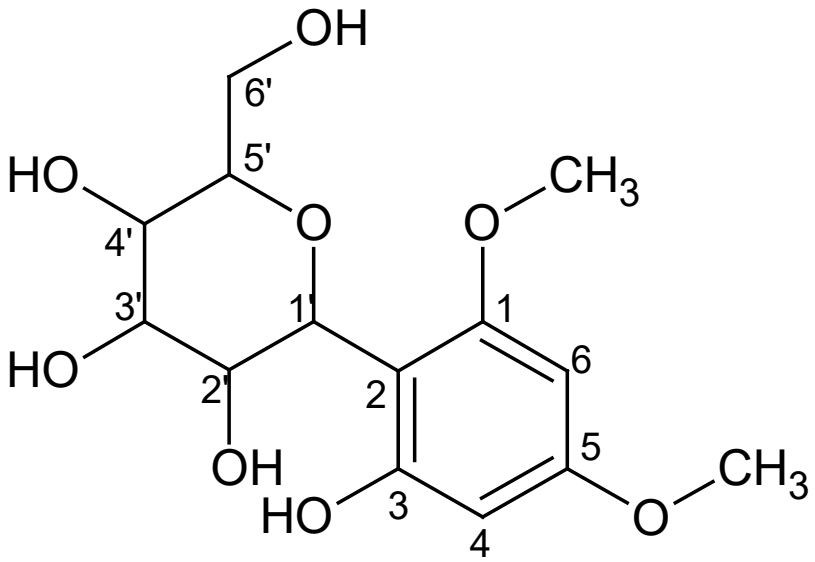
Table 2: NMR Data For NPJS 29

C-position	Experimental		Literature, Mahling and Schmidt (1993)	
	^{1}H (δ)	^{13}C(δ)	^{1}H (δ)	^{13}C(δ)
1	-	162.4	-	161.3
2	-	106.8	-	106.8
3	-	158.2	-	159.0
4	6.03	94.0	6.04	95.0
5	-	161.1	-	160.7
6	6.02	95.6	6.00	94.6
1’	4.71	104.0	4.77	104.3
2’	2.98	72.6	2.97	71.2
3’	3.40	81.4	3.34	82.2
4’	3.58	72.6	3.58	73.5
5’	3.48	81.4	3.49	81.5
6’	3.34	69.9	3.34	70.1
1-OCH_3	3.68	61.5	3.68	61.4
5- OCH_3	3.70	54.9	3.70	55.0



NPJS 29 as D-glucitol

11(a): ^{1}H-NMR SPECTRUM OF NPJS 29 (D-glucitol)

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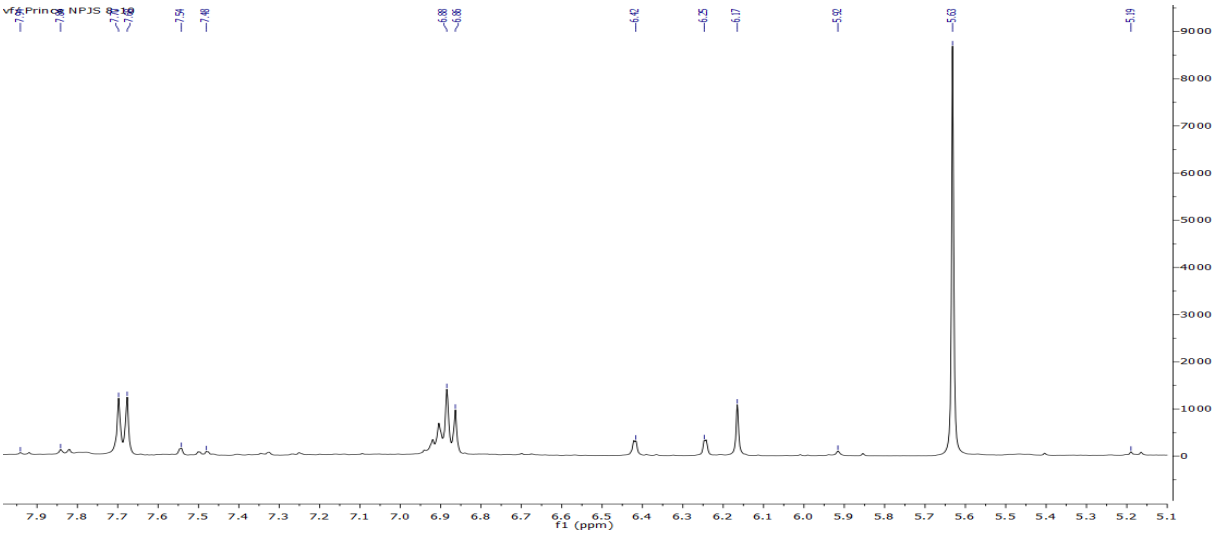
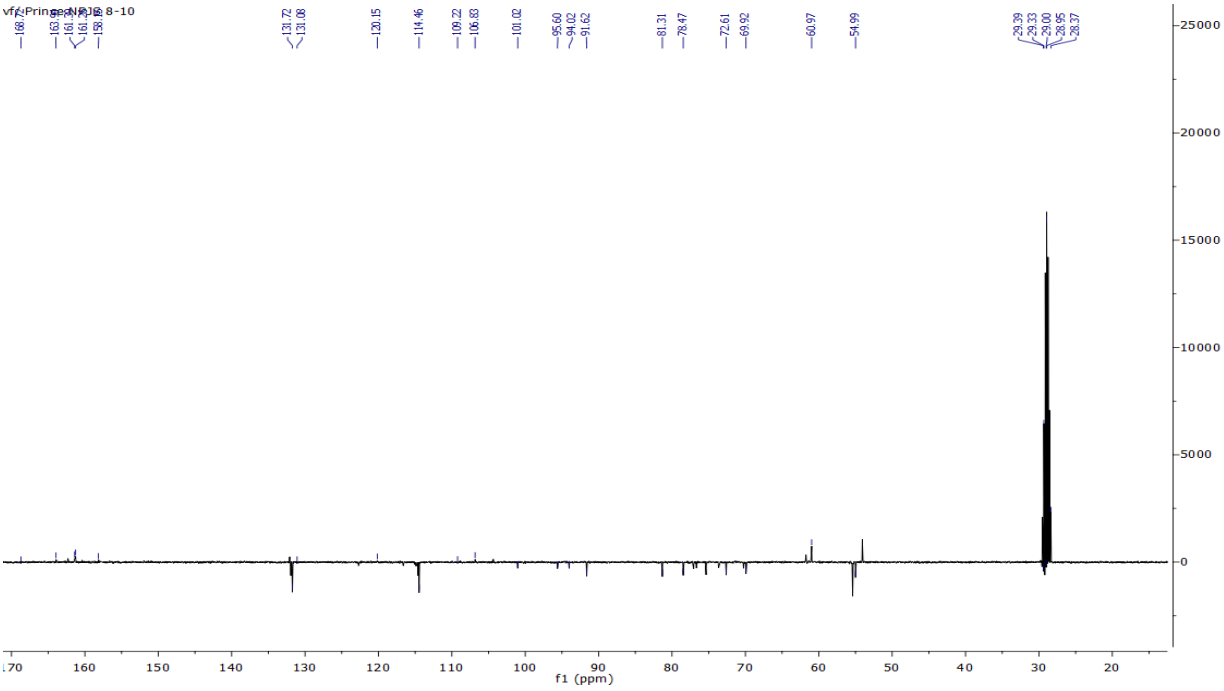


11(b): ^{13}C-NMR SPECTRUM OF NPJS 29 (D-glucitol)



11(c): COSY SPECTRUM OF NPJS 29 (D-glucitol)

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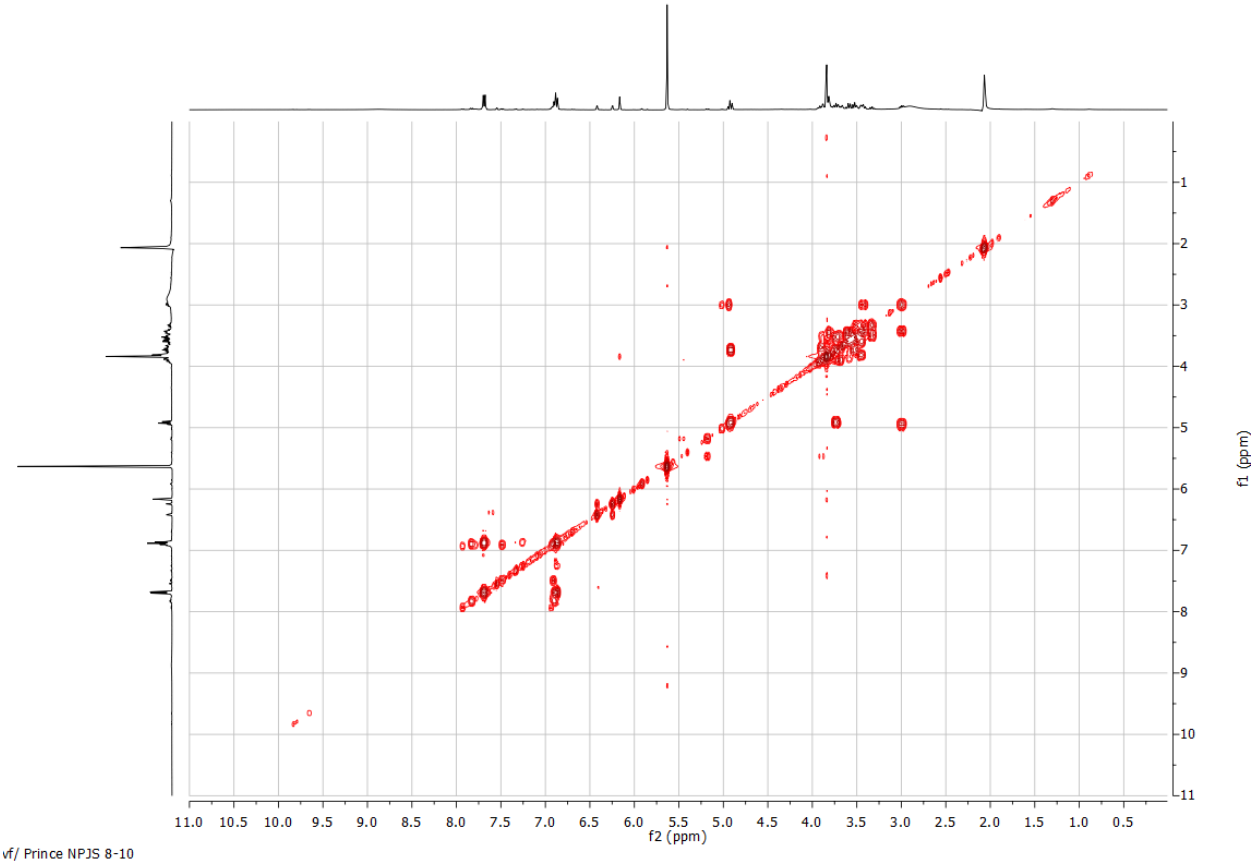
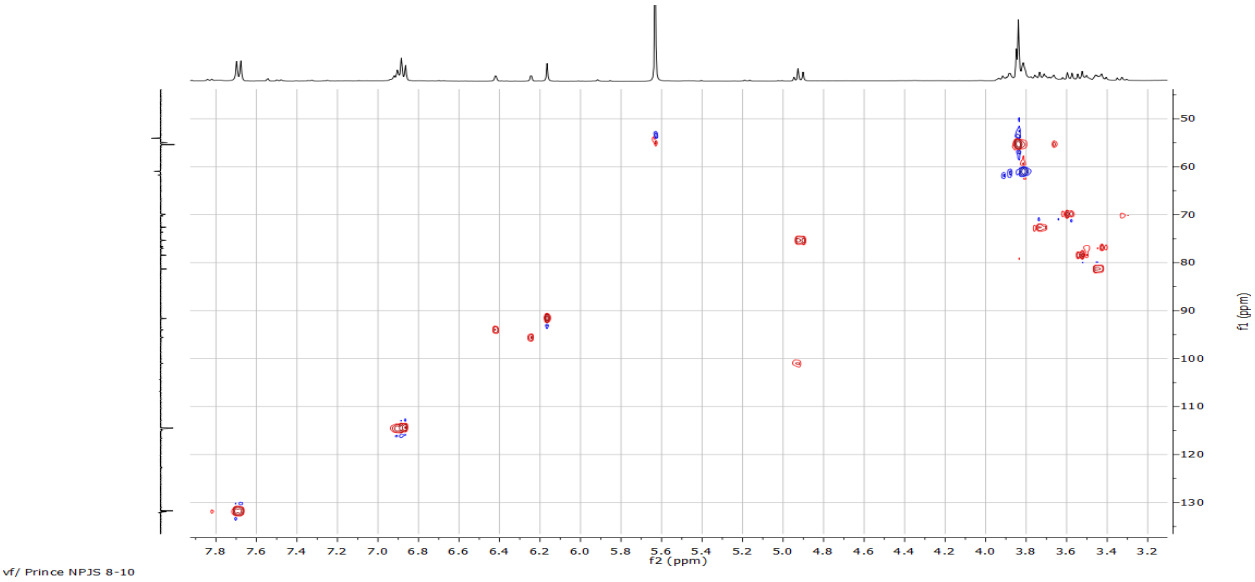


11(d): HSQC SPECTRUM OF NPJS 29 (D-glucitol)



11(e): HMBC SPECTRUM OF NPJS 29 (D-glucitol)

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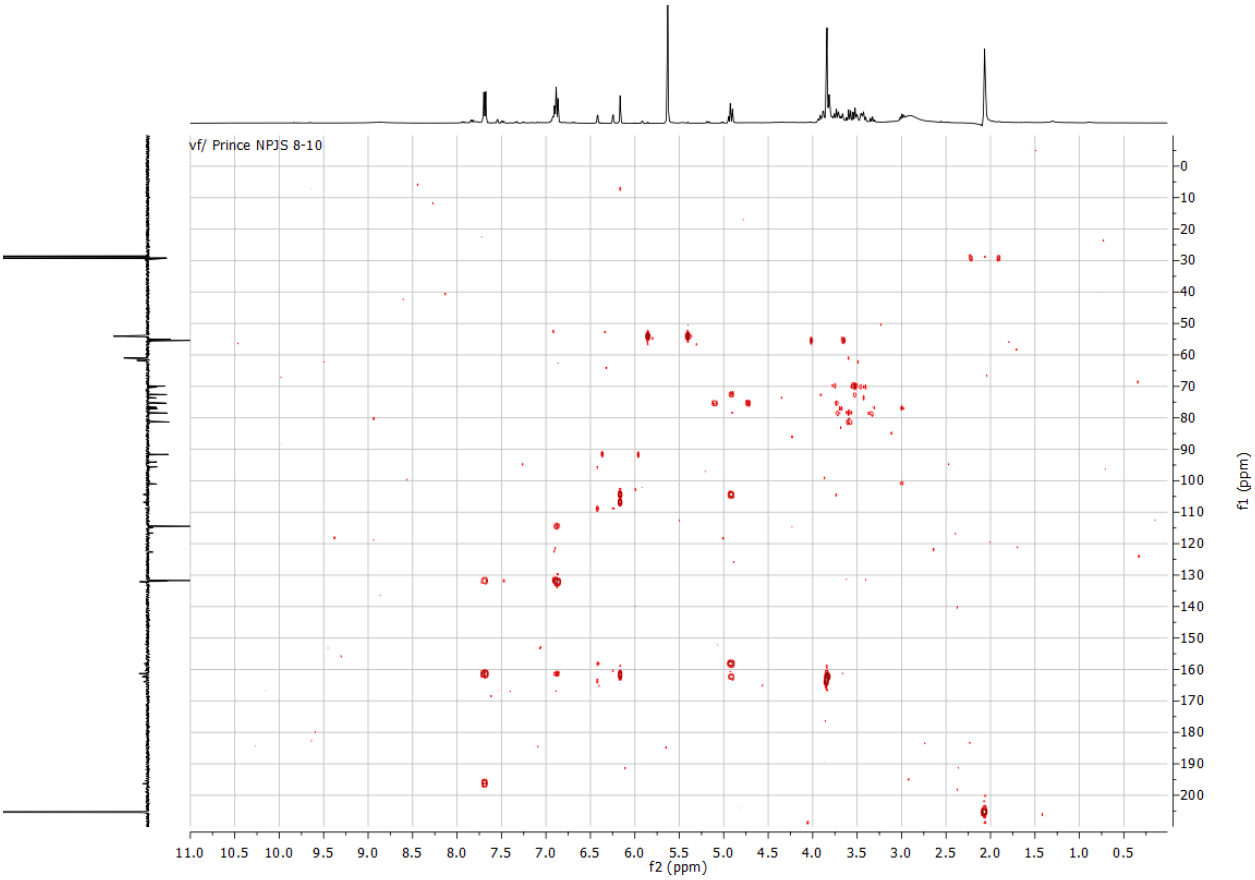

Conclusion

The isolated, characterized and identified compound is a sugar alcohol that has been reported for its antifeedant, antioxidant, antitumor, antibacterial and anti-inflammatory activities (Odeh *et al.,* 2016). It has been found to show hepatoprotective activity (Nna, 2021). The means of action of sugar alcohol is guessed to encompass the syndrome of the cell membrane action. The compound has also been defined for its antifungal activities against some clinical pathogens (Nna, 2021). The previous justification of the medicinal values of this isolated compound in this study is a proof that it is a vital medicinal compound. Its isolation from the root of *M.indica* displays it role as a principal medicinal means behind the tradomedical applications of the root in antifungal, antibacterial, anti-inflammatory, anti-tumur, antidiarrheal, antioxidant and other infectious ailments. This study has displayed evidences that the root of *Mangifera indica* to be an outright source for this compound with a hopeful antimicrobial activity. Though, this is the first study to report the presence of this compound from *Mangifera indica* root.

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