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GC-MS ANALYSIS OF PHYTOCOMPONENTS IN JUICE SAMPLE OF INDIAN CANE: *SACCHARUM BARBERI*

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Keywords:

Saccharum barberi, GC-MS, Phytocomponent

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ABSTRACT: Sugarcane is the major cash crop of the Indian tropical and sub-tropical region. Mostly the foremost part of Indian economy is based on sugarcane crop, which is cultivated major state in India. Phyto-components are the compound that occurred in plant naturally and play important role for biologically activity (Anti fungal, Anti cancer Anti diabetic etc), to prevent the many disease, scavenging and chelating the free radicals. In the present study we identified the phytocomponent presence in juice sample of Mungo 254 (*Saccharum barberi*) through GC-MS analysis. The major compound sucrose (30.64%) with retention time 12.18 and lower percentage compound was Pentanal, 2-methyl (0.10%) with 6.48 retention time. The identified compounds having biological and pharmacological activity such as Antimicrobial, Antifungal, Anticancer, Antioxidant, Antimutagenic and Hypercholesterolemic etc.

INTRODUCTION: Sugarcane belongs to the grass family (Poaceae) and is a long duration, high water and high nutrient-demanding crop which ranks amongst world's best biomass producer apart from contributing to ~95% of the global sugar pool thereby accounting for 80% of sugar produced. Sugarcane is a tropical, perennial grass that forms lateral shoots at the base to produce multiple stems, typically 3-4m high and about 5 cm in diameter. Sugarcane originated from tropical South and Southeast Asia but different species originated in different locations, with *Saccharum barberi* originating in India so also called "India cane". [1]

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Sugarcane is an important crop, as it is renewable and a natural agricultural resource providing sugar, bio-fuel, fibre, fertilizer and myriad of by products/co-products with ecological sustainability. The other products directly or indirectly obtained from sugarcane are used for making white sugar, brown sugar (Khandsari), Jaggery (Gur) and ethanol. The main by-products of sugar industry are bagasse (used in paper industry) and molasses (for making ethanol). Sugarcane juice is usually common beverage and commercialised from the cane by using mils and it can be used as nutritional supplement. [2]

The role of phytocomponents in protecting tissues and cells against destructive effects of free radicals has been greatly studied. The market in India for antioxidant rich supplements, fortified drinks and snacks has now advanced well into the mainstream, with products like green tea, antioxidant enriched

drinks, health bars, powder drink mixes, etc. The by-product of sugarcane industry, blackstrap molasses, has been recognized for its therapeutic properties. Considering, these aspects it becomes worthwhile to have a deeper insight for antioxidant properties of sugarcane.

Gas Chromatography (GC) and mass spectrometry (MS) provides a powerful tool for identifying the various compound presences in the sample. GC separate mixture in to individual components and the MS detects components or molecules on the basis of their charged ion and mass to charge ratio.
The objective of the present study was to GC-MS analysis of juice sample from the selected plant for the identification of phyto-components and their relation to biological and pharmacological activity.

MATERIAL AND METHODS:

Collection of Plant Material:

Sugarcane cultivar Mungo 254 (*Saccharum barberi*) was procured from G.B. Pant University of Agriculture and Technology, Uttrakhand in the month of September 2013.

Preparation of juice sample:

To obtain the juice sample from Mungo 254 sugarcane plant, the mature cane was crushed in cane crusher. Juice (100ml) of sugarcane was then dried in lyophilizer (Labconco, USA) under reduced pressure to obtain the powder form and dissolved in n-hexane.

GC-MS analysis of the sample:

GC-MS analysis of this sample was performed using a regular Perkin Elmer Auto System XL GC-MS analyzer. For GC-MS detection, an electron ionization energy system with ionization energy of 70eV was used. Helium gas (99.999%) was used as the carrier gas at a constant flow rate of 1.51 ml/min and an injection volume of 2µl was employed. Total GC running time was 22 min. Software adopted to handle mass spectra and chromatograms were Turbo Mass.

Identification of compounds was based on the molecular structure, molecular mass and calculated fragments. Interpretation on mass spectrum GC-MS was conducted using the database of NIST (National Institute Standard and Technology) having more than 62,000 patterns and Wiley library. The name, molecular weight and structure of the components of the test materials were ascertained by correlating with the library. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas.

RESULT AND DISCUSSION: GC-MS analysis of n- hexane juice extract obtained from Mungo 254 (*Saccharum barberi*) revealed the presence of 30 phytochemical compounds as depicted by 30 respective peaks for each compound in GC-MS chromatogram (**Table 1**, **Fig.1, 2**). Some compound sucrose (30.64%), 2-3-Deoxy-d-mannoic lactone (18.77), furancarboxaldehyde 5-(hydroxymethyl) (14.90) and 9-Octadecenoic acid (13.10) with retention time 12.18, 15.12, 14.90 and 18.13 respectively. Lower percentage compound were identified Pentanal, 2-methyl (0.10%), syringol (0.22), oleic acid (0.20) with retention time 6.48, 9.49 and 19.316 respectively.

The compounds present were of different classes such as steroids, acids, phytosterols, alkaloids, ketones, ester, etc. Among different compounds identified Isosorbide Dinitrate, 4H-Pyran-4-one, 2, 3-dihydro-3,5-dihydroxy-6-methyl-, 2-Desoxy-ribose, Oleic Acid and n-Hexadecanoic acid were found to be present in large amount as compared to other compounds based upon the peak areas of the compounds. Also, among these compounds, sucrose was the most abundant (30.64%) compound identified.

TABLE 1: IDENTIFIED COMPOUND, AREA AND RETENTION TIME OF PEAK OF SUGARCANE JUICE SAMPLE MUNGO 254 (*SACCHARUM BARBERI*).

Peak	R. Time	Area	Area%	Name
1	5.224	2030041	0.70	2-Cyclopenten-1-One,2-Hydroxy-3-Methyl
2	5.391	1117768	0.39	1,3-Dioxol-2-one,4,5-dimethyl-
3	5.608	8863127	3.07	2,5-dimethyl-4-hydroxy-3(2H)-furanone
4	5.857	2281081	0.79	Melamine
5	5.956	699128	0.24	Tridemorph
6	6.125	6569059	2.27	Cyclopropylmethanol

7	6.485	294652	0.10	Pentanal, 2-methyl-
8	6.675	794154	0.28	Levulinic acid
9	6.793	6039471	2.09	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-
10	7.061	647493	0.22	4-hydroxydihydro-2(3H)-furanone
11	7.353	466503	0.16	3Trifluoroacetoxytridecane
12	7.467	920583	0.32	1,2-Benzenediol
13	7.542	939647	0.33	Allyl Acetate
14	7.979	43026536	14.90	2-furancarboxaldehyde, 5-(hydroxymethyl)
15	8.305	1101398	0.38	Salicyl Alcohol
16	8.555	382352	0.13	Allyl hexanoate
17	8.728	1123806	0.39	2,5-pyridinedicarboxylic acid
18	8.973	639122	0.22	Ethanone, 1-(6,6-dimethylbicyclo[3.1.0]hex-2-en-2-yl)-
19	9.493	621132	0.22	Syringol
20	10.182	1039723	0.36	2-Methoxy-1,4-benzenediol
21	10.475	684047	0.24	Phenol,3,4-dimethoxy-
22	10.632	525127	0.18	Acetamide,N-(2,4-dihydroxyphenyl)-
23	12.184	88494620	30.64	Sucrose
24	15.124	54215318	18.77	3-Deoxy-d-mannoic lactone
25	16.174	505540	0.18	Cis-10-Heptadecenoic acid
26	16.390	21101418	7.31	n-Hexadecanoic acid
27	18.134	37819183	13.10	9-Octadecenoic acid
28	18.294	4642185	1.61	n-Octadecanoic acid
29	18.809	633984	0.22	9,12-Octadecadienoic acid
30	19.316	564099	0.20	Oleic Acid

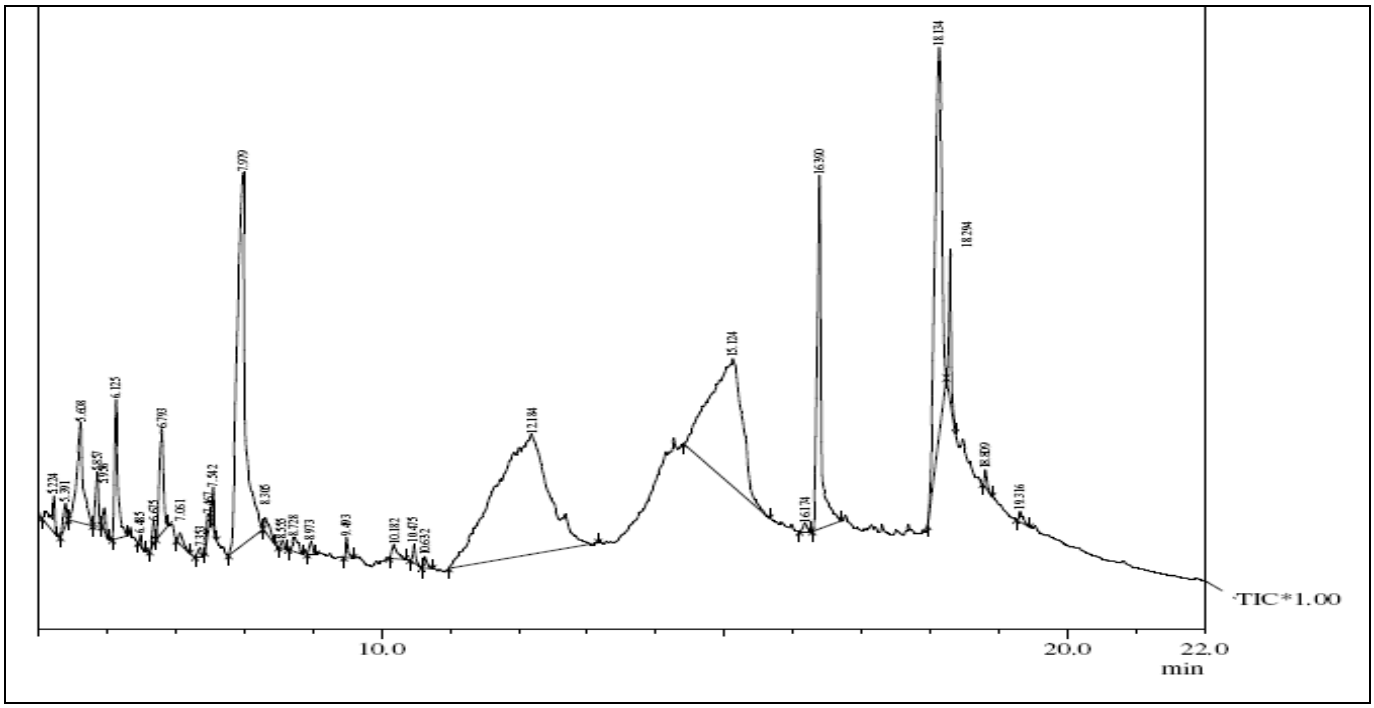
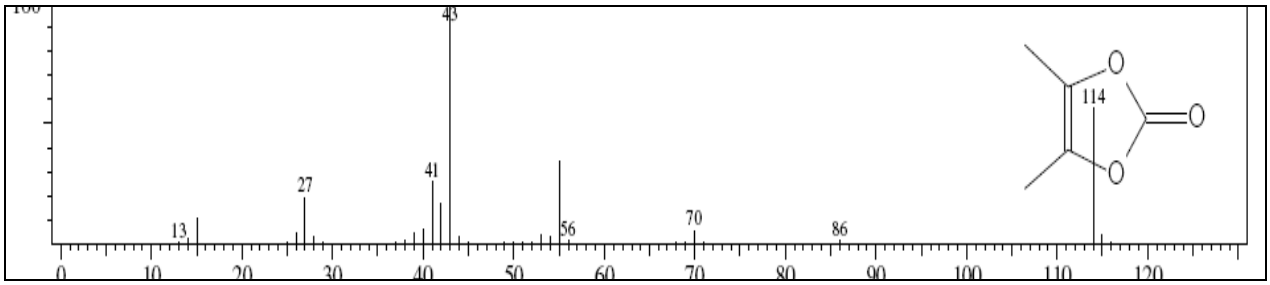
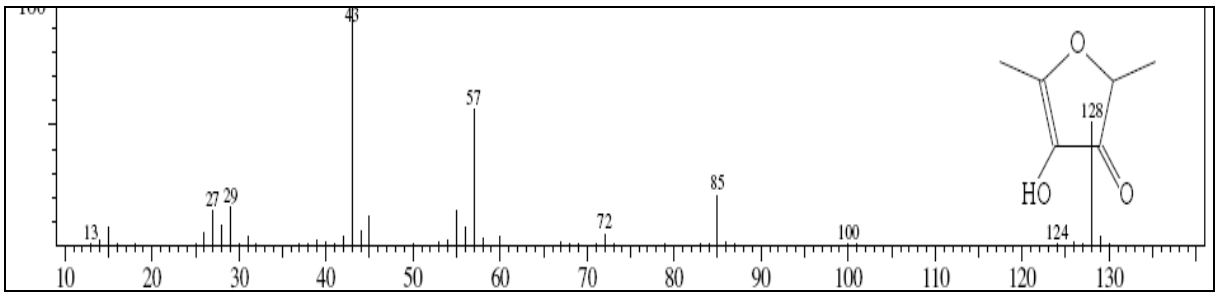


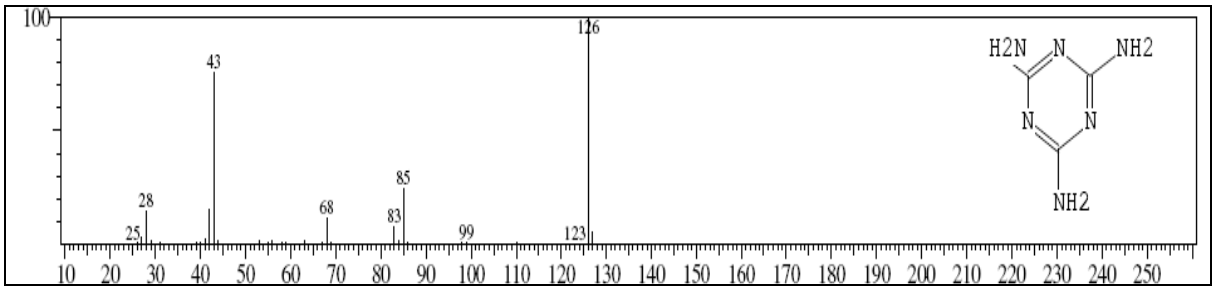
FIG.1: GC-MS CHROMATOGRAM OF JUICE SAMPLE OF MUNGO 254 (*SACCHARUM BARBERI*)



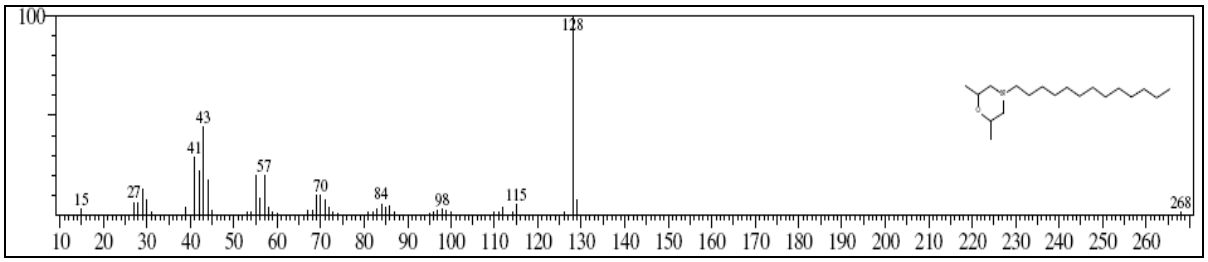
1, 3-Dioxol-2-one, 4, 5-dimethyl



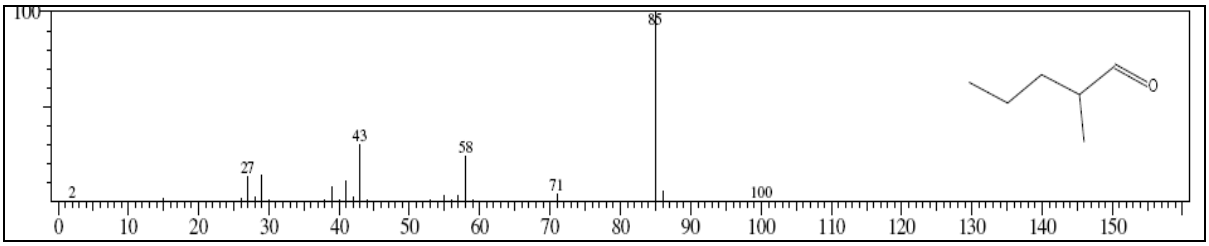
2, 5-dimethyl-4-hydroxy-3(2H)-furanone



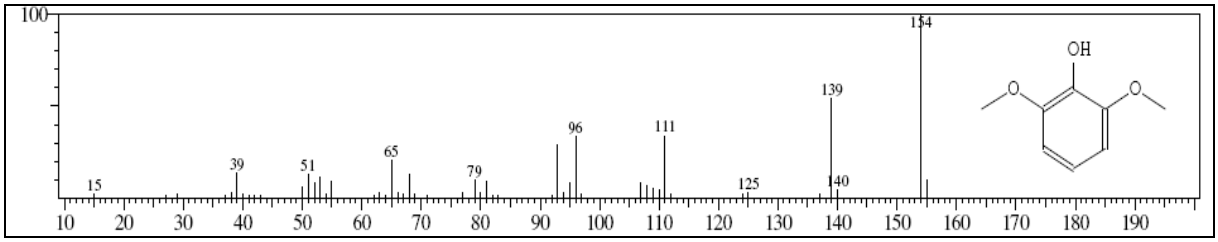
Melamine



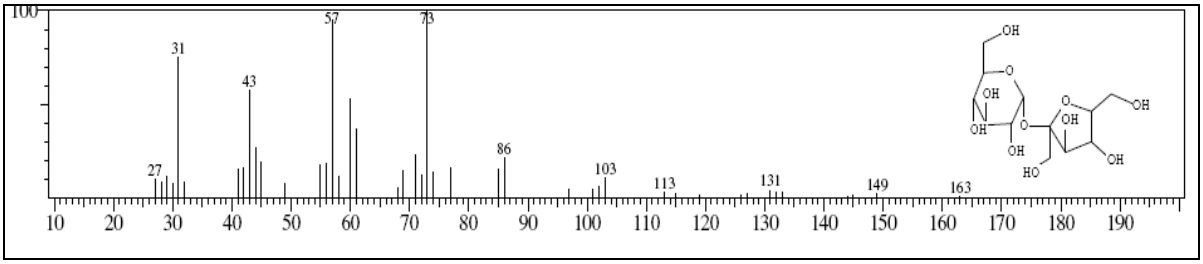
Tridemorph



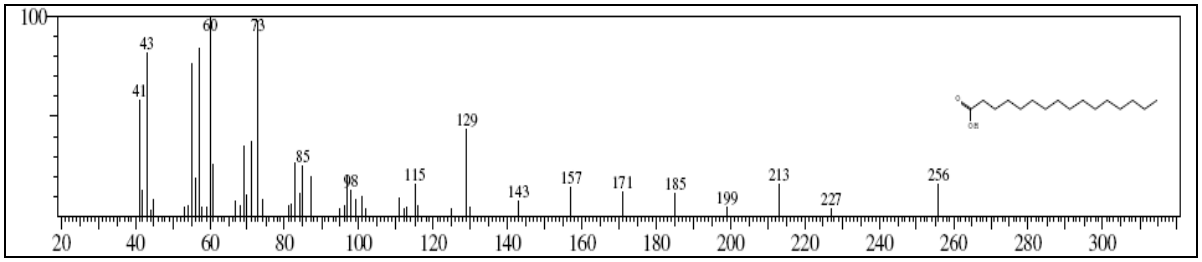
Pentanal, 2-methyl-



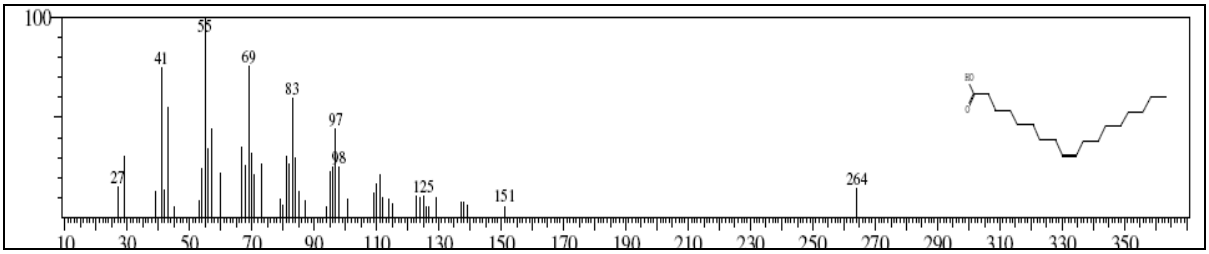
Syringol



Sucrose



n-Hexadecanoic acid



Oleic Acid

FIG.2: WORD MASS SPECTRUM OF SOME COMPOUND PRESENCE IN JUICE SAMPLE.

Irrespective of the amount or concentration (high or low) in which these compounds were found to be present, almost all these compounds have been reported to possess some pharmacological or the other biological activity (**Table 2**).

TABLE 2: BIOLOGICAL ACTIVITY OF IDENTIFIED COMPOUND IN JUICE SAMPLE OF MUNGO 254 (*SACCHARUM BARBERI*).

S.No.	Compound	Biological/Pharmacological activities	Reference
1.	1,3-Dioxol-2-one,4,5-dimethyl-	Preparation of synthetic chemotherapeutic antibiotics	3
2.	2,5-dimethyl-4-hydroxy-3(2H)-furanone	Antimicrobial activity	4
3.	Melamine	Trypanocidal Activity	5
4.	Tridemorph	Antifungal activity	6
5.	Pentanal, 2-methyl-	Antimicrobial	7
6.	Levulinic acid	Precursor to pharmaceuticals, plasticizers,	8
7.	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	Anticancer agent, Antifungal activity	9
8.	4-hydroxydihydro-2(3H)-furanone	Antifungal and antioxidant	10
9.	3Trifluoroacetoxy tridecane	Antimicrobial activity	11
10.	1,2-Benzenediol	Use as a antioxidant in electroplating baths, photographic developer Carcinogenic activity	12
11.	Allyl Acetate	fumigant activity	13
12.	2-furancarboxaldehyde, 5-(hydroxymethyl)-	Antifungal, Antibacterial activity	14
13.	Salicyl Alcohol	Antibiotic resistance	15
14.	Allyl hexanoate	Flavoring reagent	16
15.	2,5-pyridinedicarboxylic acid	Anticancer agent	17
16.	Ethanone, 1-(6,6-dimethylbicyclo[3.1.0]hex-2-en-2-yl)-	Antifungal activity	18
17.	Syringol	Antioxidant activities	19
18.	2-Methoxy-1,4-benzenediol	Antibacterial, Antidermatitic Antimutagenic, Antioxidant; Antiseptic; Fungicide etc.	20
19.	Sucrose	Antihiccup, Antiophthalmic, Antioxidant, Atherogenic, Collyrium Demulcent, Flatugenic, Hypercholesterolemic, Preservative, Triglycerigenic, Uricogenic, Vulnerary	21
20.	3-Deoxy-d-mannoic lactone	Antifungal activity	22
21.	n-Hexadecanoic acid	Antiinflammatory	23
22.	9-Octadecenoic acid	Antiandrogenic, Allergenic, Hypocholesterolemic	24
23.	n-Octadecanoic acid	5-αreductase inhibitor, Hypocholesterolemic	24
24.	9,12-Octadecadienoic acid	Anticarcinogenic antiatherogenic, antioxidant, anti-inflammatory	25
25.	Oleic Acid	Treatment of Skin Papillomas	26

For instance, Syringol and 4-hydroxydihydro-2(3H)-furanone are known to possess antioxidant activities. Many phytochemical compounds identified such as, Tridemorph, [27] Pentanal, 2-methyl, 4H-Pyran-4-one, 2,3-, dihydro-3,5-dihydroxy-6-methyl-, 4-hydroxydihydro-2(3H)-furanone, 2-Furancarboxaldehyde, 5-(hydroxymethyl)- have been reported to be antimicrobial (antibacterial or antifungal) in nature. [7, 28] n-Hexadecanoic acid is a significantly important phytochemical compound, also found to be present in the extract and is known to have antioxidant, [14, 23] hypocholesterolemic, nematicide, pesticide, antiandrogenic, hemolytic,5-alpha reductase inhibitor activities. [10] Oleic has been reported to be effective in treatment of skin papillomas. [26] 2-benzenedicarboxylic acid and Palmitic acid are two other biologically active compounds, which possess anti tumor and anticancerous properties. Isosorbide dinitrate has been reported to be utilized in vasodilator therapy of heart failure. [29]

Stearic acid is involved in lowering of plasma cholesterol levels. 1,2-Benzenediol possesses carcinogenic activity, [8] Levulinic acid is a Precursor to pharmaceuticals, Melamine possesses trypanocidal activity, [5] 1,2,3-Propanetriol, 1-acetate is anti-dipogenic in nature.

CONCLUSION: From the results obtained from GC-MS analysis of juice of sugarcane, it can be concluded that beside being sugar (carbon) source the plant also exhibits several biological and pharmaceutical properties which provide an insight to the medical value of sugarcane plant which can be further evaluated to optimize how the plant may be utilized to explore its medicinal potential.

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