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GC-MS analysis of biologically active compounds present in two different extracts of *Sansevieria cylindrica*

Hanna Jeeja Alexander[1], Bojaxa A Rosy[2], Catherine Sheeja V[1], Blessy R[1], Ani Besant S[1]

[1] Research Scholar, Department of Botany, Holy Cross College (Autonomous) Nagercoil, Affliated to Manonmaniam Sundaranar University, Tamil Nadu, India

[2] Assistant Professor, Department of Botany, Holy Cross College (Autonomous) Nagercoil, Affliated to Manonmaniam Sundaranar University, Tamil Nadu, India

Abstract
The present study focused the biologically active compounds present in two different crude extracts of *Sansevieria cylindrica*. The shade dried leaves were powdered and subjected to selective successive extraction using two different solvents i.e. benzene & hexane to obtain plant extracts. After that each of the extracts was further exposed to gas chromatography -mass Spectrometry. The resolution of the different biologically active compounds from crude extract of *S. cylindrica* using gas chromatography -mass spectrometry revealed different types of high and low molecular weight chemical compounds with varying properties. These chemical compounds are biologically and medicinally important. The two extracts possess major bioactive compounds that were identified and characterized spectroscopically. Thus, identification of different biologically active compounds in the leaf extracts of *S. cylindrica* shows biological and pharmacological activities.

Keywords: *Sansevieria cylindrica*, active compounds and GC-MS analysis

Introduction
Plants are reputed to have beneficial effects in the traditional system of medicine. The traditional medicine can be used to treat chronic as well as infectious diseases (Duraipandian *et al* 2006) [1] India is the largest producer of medicinal herbs and is called the botanical garden of the world Ahmedull and Nayar (1999) [2]. Plants are a rich source of secondary metabolites with remarkable biological activities. Natural products that come out from medicinal plants are important for pharmaceutical research and for drug development as a source of therapeutic agents. At present, the demand for herbal or medicinal plant products has increased significantly Dhivya and Manimegalai (2013) [3]. Different biological activities like anti-microbial, anti-oxidant, sedative and anxiolytic effects of the plant extracts due to the presence of active compounds. The secondary metabolites present in plants are the important source with a variety of structural arrangements and properties Kalaisezhiyen and Sasikumar (2012) [4]. Volatile compounds play an important role in health care systems by the medicinal plants. Volatile compounds are identified by the GC-MS analysis Hassanpouraghdam (2009) [5]. Gas chromatography-Mass spectrometry (GCMS) is a hyphenated analytical technique that combines the separation properties of gas-liquid chromatography with the detection feature of mass spectrometry to identify and determine the organic compounds from complex mixtures. Recently this technique was proved to be a valuable method for the analysis of nonpolar components and volatile essesntial oil, fattyacids, lipids and alkaloids (Xie *et al* 2013) [6]. *S. cylindrica* Bojer ex Hook,commonly known as Indian bowstring's hemp, is a stem-less herb arising from a creeping underground rhizome. The plant has long been the source of a fiber used for bowstring in India. The plant has also been reported to contain some important medicinal compounds Anis and Shahzad (2005) [7]. *S. cylindrica* is filled with bionutrients and is one of the most recommended plants for improving air quality. It is able to absorb 107 types of toxins, including air pollution, cigarette smoke (nicotine) (Cushnie *et al* 2008) [8]. Previous work reported that the compounds separated from this plant showed antifungal activity (Pettit *et al* 2005) [9], exhibiting inhibition of the capillary permeability activity (Da Silva Antunes *et al* 2003) [10] and antioxidant activity (Said *et al* 2015) [11]. So, the present study was aimed to investigate the chemical components and identification of the compounds by subjecting it to GC-MS analysis.

Materials and Method
Collection of Plant Material and Preparation of Plant Extracts
The collection of plant materials was done from Holy Cross College (Autonomous) campus, Nagercoil. Taxonomic identification of the plant was identified and authenticated by Dr. S. John Britto, Former Director, the Rapinat Herbarium and center for molecular systematics, St. Joseph's college Trichy-Tamil Nadu. India. A Voucher specimen has been deposited at the Rapinat Herbarium, St. Josephs College, Thiruchirappalli, Tamil nadu, India.

Preparation of Plant Extract
The collected plants were cleaned properly to remove adhering sand and dust particles on the outer surface of the plant. Then the plant was cut in to small pieces and shade dried. These dried samples were stored in airtight container for future purposes. The sample can be extracted by using two solvents benzene and hexane then the extract was evaporated to dryness using rotary evaporator. The final residue obtained was then subjected to GC-MS analysis.

The GC-MS Analysis
The benzene and hexane extract of plant was subjected to GC-MS at the Council of Scientific and Industrial Research-Central Salt and Marine Chemical Research Institute, Bhavnagar, Gujarat by using Q2010 Gas Chromatography Mass Spectrometer (GC-2020 coupled with GC-MS QP-

2010) equipped with an autosampler (AOC-5000) Shimadzu, Japan.

Identification of Phytocomponents

Injection volume was 200µl and samples were run full in GC-MS apparatus and interpret on mass-spectrum using the database of National Institute Standard and Technology (NIST) having more than 62,000 patterns. The spectrum of the unknown components was compared with the spectrum of known components stored in the NIST library. The name, molecular weight, and structure of the components of the test materials were ascertained.

Result and Discussion

The bioactive compounds present in benzene and hexane extracts obtained from *S. cylindrica* leaves are shown in Tables 1 & 2. Thirteen phytoconstituents were identified from the benzene extract of *S. cylindrica* with the retention time between 4.50 to 19.66 was presented in Figure.1. Di-n-octyl phthalate recorded the highest peak area (87.96%) in the chromatogram and the lowest peak area is recorded in hexadecanoic acid and n-octyl ester (4.0%). The hexane extract showed the presence of 11 phytoconstituents with the retention time ranged between 4.18 to 19.67 was presented in Figure.2. 1, 2-benzenedicarboxylic acid and dihexyl ester recorded the highest peak area (38.84%) and the lowest peak area recorded by Phthalic acid and di(oct-3-yl) ester (29.08%). GC–MS analysis of these two extracts revealed the presence of various bioactive compounds. Thirteen phytoconstituents of benzoic extract are identified in *S. cylindrica* with the retention time between 4.50 to 19.66. The Hexane crude extract had 11 phytoconstituents with the retention time ranged between 4.18 to 19.67. The available literature supports that the identified compounds of *S.cylindrica*. Has the biological activities like antioxidant, antibacterial, antifungal, antidiabetic and anticancer activities. The common properties of tetrahydro furan are their toxicity against cell of foreign organisms. These activities have been widely studied for their potential use antinflamatory in exhibiting anti- angionic, antibacterial, antioxidant etc. in the elimination and reduction of serious human diseases like cancer cell lines (Krauss *et al* 2008; Dahiya and Gautam 2010) [12,13]. Diisooctyl phthalate possess antioxidant,antidiabetic, antibacterial activity (Shen *et al* 2019) [14]. 1, 2 – Benzene dicarboxylic acid, bis (1-methylethyl) ester possess Phobic disorder treatment,Bipolar disorder treatment, neuropathy treatment (Li *et al* 2012) [15]. n-hexadecanoic acid which has been previously proved to have anti-inflammatory, antioxidant, hypocholesterolemic, flavour, nematicide, pesticide, antiandrogenic activities (Henry *et al* 2002; Kumar *et al* 2010) [16,17]. Phthalic acid derivatives were suggested to have been used to cure chronic cardiovascular and cerebrovascular diseases and had anti-tumour, anti-inflammatory, antibacterial functions (Ge *et al* 2015) [18]. The anti-microbial activities were believed to be due to phthalic acid derivative Nakalembe and Kabasa (2012) [19]. Several authors have shown that natural compounds possess important biological activities, such as antitumor, antihepatotoxic, antioxidant, anti-inflammatory, estrogenic and antibacterial activities (Rizvi *et al* 2015) [20].

Table 1: Bioactive chemical compounds of benzene extract from *Sansevieria cylindrica* leaf.

SL. no.	Compound name	Molecular formula	Molecular weight	Biological activity
1	2-Furanol,tetrahydro-	C_4H_8O	88.11 g/mol	Antioxidant, Antiviral, Antiinflammatory
2	3- Buten-1-ol	C_4H_8O	72.11 g/mol	Antibacerial, Anticataract, Antileprosy
3	Tetrahydrofuran	$(C_2)_3CH_2O$	72.11 g/mol	Antineurotic, Antineoplastic, Antithyroid
4	1,4 - Butanediol	$C_4H_{10}O_2$	90.2 g/mol	Antiviral, Antiulcerative, Antifungal
5	2H-Pyran-3 (4H)-one,dinydro-	$C_4H_{10}O_2$	100. 1 g/mol	Rheumatoid anthritis, Antiinflammatory, Antileprosy
6	Hexadecanoic acid,n-Octyl ester	$C_{24}H_{48}O_2$	368 g/mol	Anticatract, Antithyroid, Antifungal
7	Carbonic acid,2-ethylhexyl nonyl ester	$C_{18}H_{36}O_3$	300 g/mol	Antibacterial, Antidiabetic, Antileprosy
8	Carbonic acid,2-ethylhexyl nonyl ester	$C_{19}H_{38}O_3$	314 g/mol	No activity reported
9	Carbonic acid,2-ethylhexyl octyl ester	$C_{17}H_{34}O_3$	286 g/mol	No activity reported
10	Hexadecanoic, octyl ester	$C_{24}H_{48}O_2$	368 g/mol	Antiviral, Cardioprotectant, Antituberculosic
11	Di-n-Octyl phthalate	$C_{24}H_{38}O_4$	390 g/mol	Anesthetic general, Antianginal, wound healing.
12	Bis (2-ethylhexyl) phthalate	$C_{24}H_{38}O_4$	390.6 g/mol	Antithrombotic, Antirickettsial, Antibacterial
13	Diisooctyl phthalate	$(C_8H_{17}COO)\ C_6H4$	390.6 g/mol	Antibiotic, Antioxidant, Antibacterial, Antidiabetic

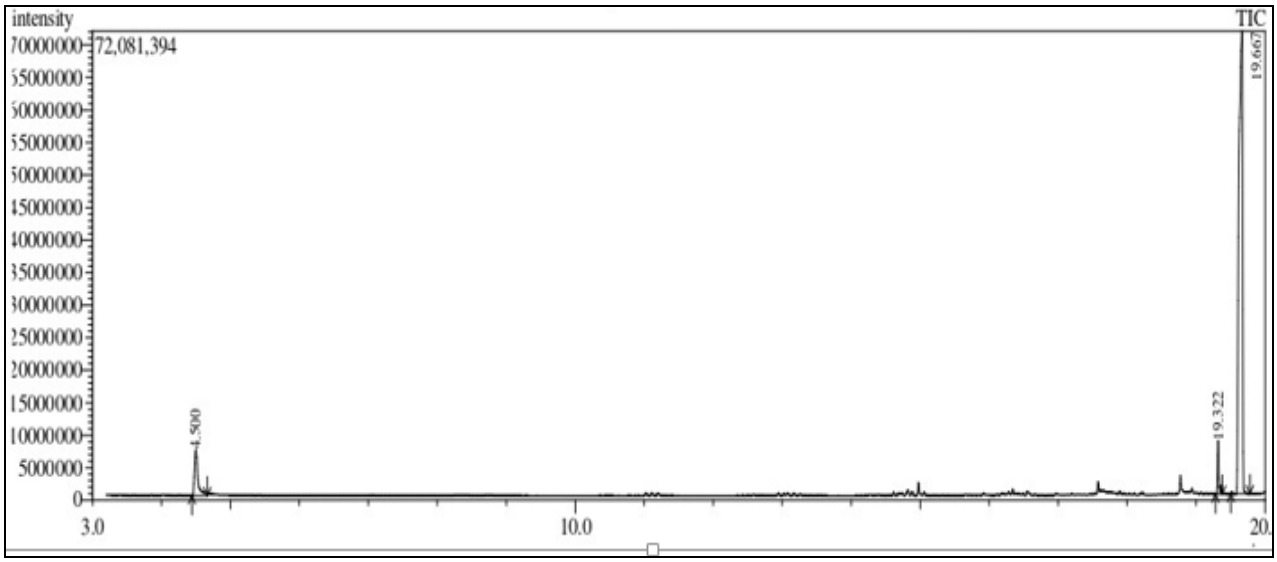

Fig 1: GC-MS chromatogram of the benzene extract of *Sansevieria cylindrica* leaf

Table 2: Bioactive chemical compounds of hexane extract from *Sansevieria cylindrica* leaf.

Sl.no.	Compound name	Molecular formula	Molecular weight	Biological activity
1	Phthalic acid,di (oct-3-yl)ester	$C_{24}H_{38}O_4$	390.6 g/mol	Phobic disorders treatment, Antiviral, Antimetastatic, Antidiabetic
2	Phthalic acid,6 – methylhept-2-yl octyl ester	$C_{24}H_{38}O_4$	390.6 g/mol	Antiviral, Antirickettsial, Antineoplastic
3	Phthalic acid, octyl 2- pentyl ester	$C_{24}H_{32}O_4$	348.5 g/mol	Antifungal, Antinpyretic, Antioxidant
4	Phthalic acid, octyl 2- propyl pentyl ester	$C_{21}H_{32}O_4$	348.5 g/mol	Sickle cell anaemia treatment, Antithyroid, Antiinflammatory
5	Phthalic acid, hexy -3- yl octyl ester	$C_{23}H_{36}O_4$	334.4g/mol	Phobic disorders treatment, Dimentia treatment, Anticatract
6	1,2 – Benzene dicarboxylic acid, dihexyl ester	$C_{20}H_{30}O4$	306.4g/mol	Antiparkinsonian, Antidiabetic, Antibacterial, Gout treatment
7	Phthalic acid,2- ethyl butyl propyl ester	$C_{14}H_{18}O_4$	306.4 g/mol	Antibacterial, Antieczematic, Antituberculosic
8	1,2 – Benzene dicarboxylic acid, bis(1-methylethyl) ester	$C_{14}H_{18}O_4$	250.29 g/mol	Phobic disorder treatment, Bipolar disorder treatment, neuropathy treatment
9	Phthalic acid,6- ethyl- 3- octyl butyl ester	$C_{22}H_{34}O_4$	362.5 g/mol	Antifungal, Antiacne, Alzheimers disease treatment
10	Phthalic acid, 8 – chlorooctyl hexyl ester	$C_{22}H_{33ClO4}$	396.9 g/mol	Anticarcinogenic, Renal failure treatment, Antithyroid
11	Toluene	C7H8	92 g/mol	Antibacterial, Dimentia treatment, Narcolepsy treatment

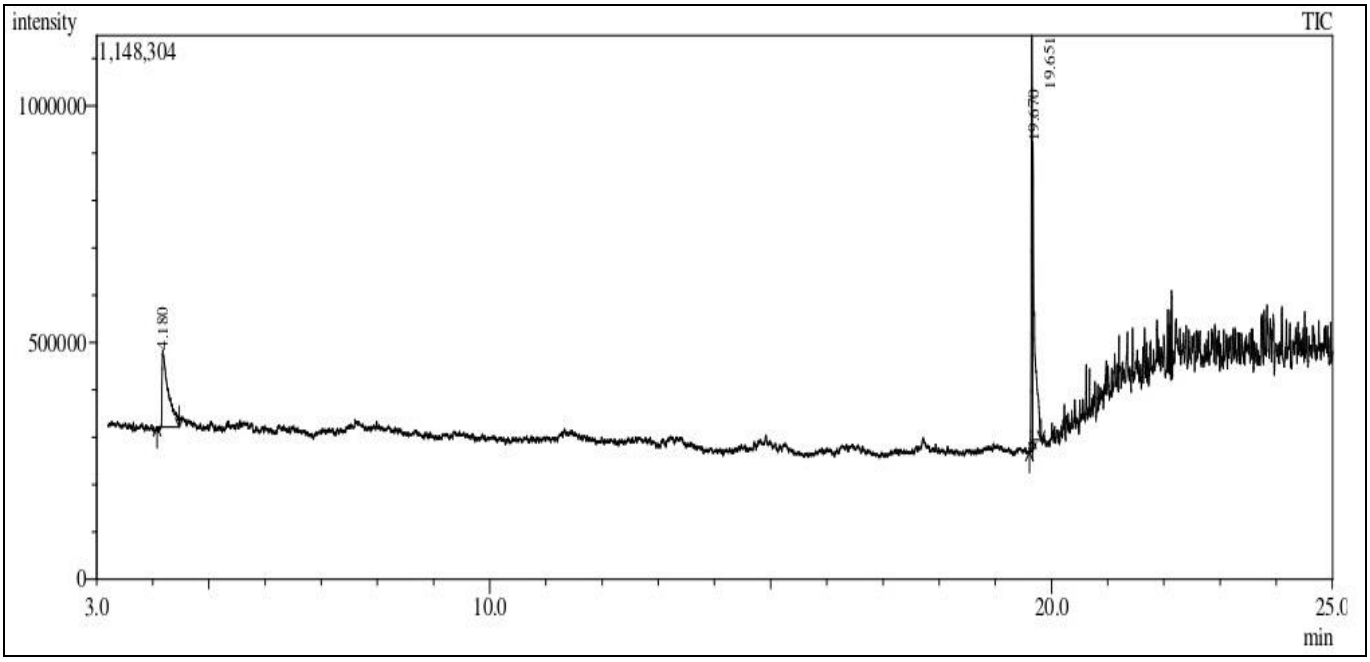

Fig 2: GC-MS chromatogram of the hexane extract of *Sansevieria cylindrica* leaf

Conclusion

This type of GC-MS analysis is the first step towards understanding the nature of active principles in this plant. Thus, the plant studied can be used as a potential source of new useful drugs. The phytochemical characterization of the extracts, the isolation of responsible bioactive compounds and their biological activity are necessary for future studies. The results of the study clearly indicate the presence of active principles with the pharmacological activities in the two extracts of *S.cylindrica*. So, this can be effectively used to treat diseases like cancer, diabetis mellitus, arthritisand inflammation and also it antineoplastic, anticatract, antibacterial, antifungal, cardioprotectant Therefore, it is recommended as a plant of phytopharmaceutical importance.

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