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Phytochemical analysis of coconut shell (*Cocos nucifera* Linn.) using gas chromatogrphy - mass spectrometry (GC-MS)

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Abstract
In the field of Ayurvedic practice, there is scarcity of commonly used herbal sources; creating need for search of alternatives. Meanwhile there exists folklore and traditional practices in the treatment of various ailments. Such practices are to be evaluated scientifically to enrich the ayurvedic pharmacopeia. The Medicinal value of coconut shell (*Cocos nucifera* Linn. of Arecaceae family) is not much explored by medical science. Before going to the pharmacological action, there must be a clear cut idea about nature and chemical characters of the plant. This study was implemented to actuate the organic compounds present in the active fraction of *Cocos nucifera* Linn shell extract using Gas Chromatography–Mass Spectrometry (GC-MS). The analysis of aqueous distillate of *Cocos nucifera* Linn. Shell powder revealed the existence of 11 compounds including Dodecanoic acid, Tetradecanoic acid, Pentadecanoic acid, Hexadecanoic acid, Squalene. The results of GCMS compounds in the extract were relevant to further researches on the medicinal uses of *Cocos nucifera* Linn shell.

Keywords: *Cocos nucifera* Linn. Shell, GC/MS, bioactive components

Introduction
Mankind is gifted with remedy for all our ailments from the nature itself. Ethno medicinal and folklore leads have helped in the discovery of a number of bioactive molecules useful in the treatment of many ailments, globally. India is a gifted country from biodiversity and ethno medicinal point of view due to the presence of multiethnic groups. Meanwhile, an increasing demand for Ayurveda and herbal medicines has resulted in scarcity of commonly used herbal sources creating a need for the search of alternatives. "Nothing on earth is non- medicinal", is one of the basic principles of Ayurvedic pharmacology which opens up a wide room for research. The WHO however notes that "inappropriate use of traditional medicines or practices can have negative or dangerous effects" and that "further research is needed to ascertain the efficacy and safety" of several of the practices and medicinal plants used by traditional medicine systems [1].

There is a folklore claim existing in Kerala regarding the internal usage of water boiled with coconut shell pieces in hyperlipidemia. *Cocos nucifera* Linn. Of Arecaceae family commonly known as coconut tree, is considered as an important fruit crop in the tropical countries. The medicinal value of coconut shell, the usually discarded part of the plant, is not at all much explored by medical science; although it's having several other utilities. Being a cheap and easily available drug of our surroundings, studies on its medicinal values receive much attention. Moreover as per the WHO norms stated above, it is important to evaluate the safety and efficacy of the drug. There are no available studies on the internal usage of coconut shell. A prior in-vivo study found that the internal administration of aqueous extract of ripe dried coconut shell was not showing any acute toxicity and was having significant anti-hyperglycemic and anti hyperlipidemic effects in animal model [2].

For the widespread acceptance of herbal medicines; standardization, quality control of the herbal materials, as well as evaluation of efficacy, safety and quality of the Phyto-pharmaceuticals are indispensable [3]. Identification of individual components of complex mixtures of phytochemicals requires the use of several techniques. One of the most popular methods of studying phytochemical composition is GCMS (Gas Chromatography Mass Spectrometry), which allows the identification of the specific natural compounds found in a plant extract by comparing their relative retention times, indices and their mass spectra. Aim of this study is to determine the organic compounds present in the active fraction of *Cocos nucifera* Linn shell extract with the aid of GC-MS Technique, which may provide an insight in its use in folklore medicine. Preliminary phytochemical analysis data have revealed that *Cocos nucifera* endocarp is a rich resource of phenolic and flavonoid compounds which are

Responsible for diverse biological activities in medicinal plants beneficial to human health and disease prevention [2].

Materials and Methods

Ripe coconut shells were collected during December 2016 from Palakkad district, Kerala. After cleaning & drying in sunlight, it was pulverized to coarse powder. The GCMS Analysis for the study was conducted at Care keralam Ltd, KINFRA small Industries Park, Koratty, Trichur. Volatile oil content of the drug was determined by distilling the drug with distilled water using Clevenger apparatus. 50 gm of the drug was done hydro distillation and 0.1ml of volatile oil was obtained.

The first step of GCMS was started by injecting the sample to the injected port of the Gas chromatography (GC) device using a Thermo Gas Chromatography-Trace Ultra Ver: 5.0. The GC instrument vaporizes the sample and then separates and analyzes various components. Each component ideally produces a specific spectral peak that may be recorded on a paper chart electronically. The time elapsed between elution and injection is called the "retention time". Differentiation between some compounds was identified using the Retention time (RT). The percentage (%) of the compositions of the drug analysis by GCMS was obtained from the percentage area of the peak or the height of the peak in the chromatograms.

Observations

The phytochemical components have been analyzed qualitatively by the common methods using chemicals. The chromatogram identified 11 phytochemicals as main constituents. 109 known compounds were identified in terms of RT & area%. Among the 109 compounds those having similarity% more than 90 & area% more than 0.1 were taken to be the main compounds.

Presence of the following components was indicated in the analysis.

Table 1: Components identified from the aqueous distillate of *Cocos nucifera* Linn the Chromatogram is shown below.

S. No	RT	Name of the Compound	Area%
1	25.520	2-Thiapentane, 4-(9-borabicyclo [3. 3.1]non-9-yloxy)	0.01
2	29.315	Dodecanoic acid	4.07
3	30.048	Asarone	0.11
4	31.202	Ar-tumerone	0.16
5	33.692	Tetradecanoic acid	7.00
6	35.553	Pentadecanoic acid	0.38
7	37.098	cis-9-Hexadecenoic acid 9-Hexadecenoic acid Cyclopentadecane	0.28
8	37.618	n-Hexadecanoic acid	5.07
9	40.651	9,12-Octadecadienoic acid (Z,Z)-9-Eicosyne	0.16
10	40.761	9-Octadecenoic acid, (E)-	0.99
11	510.203	2,6,10,15,19,23-hexamethyl-, (all-E)Squalene	0.34

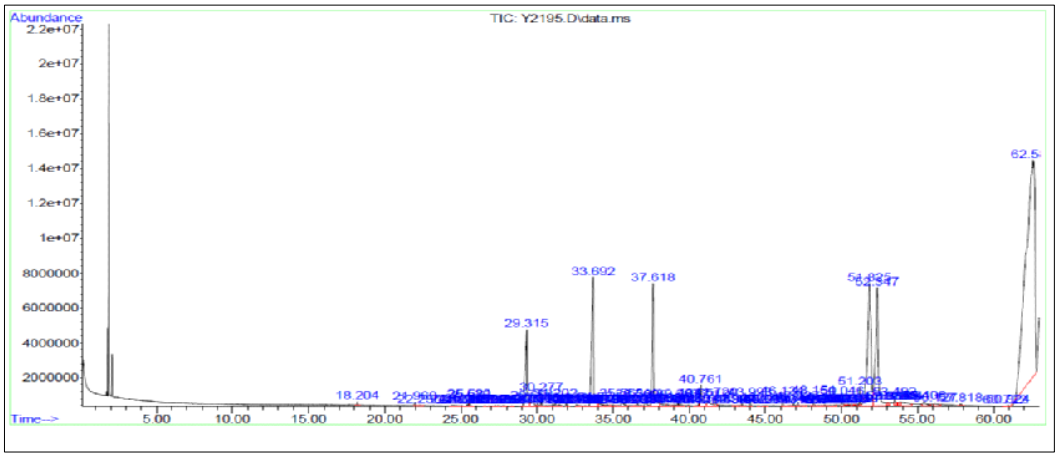

Fig 1: GC-MS Chromatogram showing the Phytochemical Components from aqueous distillate of *Cocos nucifera* Linn

Discussion

The present study was carried out using GCMS Analysis for Phytochemical components from aqueous distillate of *Cocos nucifera* Linn. Identified components of ripe dried coconut shell (*Cocos nucifera* Linn) were tabulated. Available and identified activities of the components are described below. Some of the GC-MS peaks remained unidentified, because of lack of data of corresponding compounds.

1. Dodecanoic acid, ethyl Este

Synonyms: Ethyl laurate; Lauric acid; ethyl ester; Ethyl dodecanoate. This compound was reported with antibacterial, antioxidant, antiviral, hypercholesterolemic and candidicide activity [4].

2. Tetradecanoic acid

Synonyms: Meristic acid; n- Tetradecanoic acid; n-Tetradecoic acid; Neo-Fat14; Cord acid; 1-Tridecanecarboxylic acid; n-Tetradecan-1-oic acid. The compound was reported to be a lubricant and Nematicide and also showed antibacterial activity against Gram-positive and Gram-negative bacteria [4]. The compound was also reported with antioxidant, antimicrobial, cancer preventive, cosmetic, weedicide and hypocholesterolemic activity [5].

3. N-Hexadecanoic acid

Synonyms**:** Hexadecanoic acid; n-Hexadecoic acid; Palmitic acid; Pentadecanecarboxylic acid. The effect of dietary intake of high palmitic acid levels in combination with other fatty

acids in normal subjects was assessed. Palmitic acid (10% of energy) was fed in conjunction with decreasing levels of linoleic acid to determine if a threshold level of linoleic acid prevented palmitic acid from being hypercholesterolemia.

4. 9, 12-Octadecadienoic acid

Synonyms**:** cis-9,cis-12-Octadecadienoic acid; cis, cis Linoleic acid; Grape seed oil; Linoleic; Linoleic acid; Linolic acid; Polylin No. 515; Telfairic acid. 12-Octadecadienoic acid is a doubly unsaturated fatty acid, occurring widely in plant glycosides. It is an essential fatty acid in mammalian nutrition and is used in the biosynthesis of prostaglandins and cell membrane.

5. Squalene

Synonyms: 2, 6, 10, 14, 18, 22-Tetracosahexane, 2, 6, 10, 15, 19, 23-hexamethyl-; Skvalen; Spinacene; supraene. This compound was reported with following potential properties like antioxidant, antitumor and Cancer preventive properties, immune stimulant and also as a lipoxygenase inhibitor [5]. By several studies

Table 2: Consolidation of the activity of GCMS identified components

S. No	Name of the Compound	Identified Activity
1	Dodecanoic acid	Antibacterial, Antiviral, Antioxidant, Candidicide, Hypercholesterolemic
2	Tetradecanoic acid	Antioxidant, Antimicrobial, Anti-Cancerous, Cosmetic, Weedicide, Hypercholestremic
3	n-Hexadecanoic acid	Hypocholestremic
4	9-Octadecenoic acid	Flavour, Anti-Cancerous, Antiinflammatory
5	Squalene	Antitumor, Antioxidant, Immunostimulant, Lipoxygenaseinhibitor, Hypocholestremic

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