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Subramanian Arivoli
Assistant Professor,
Department of Zoology,
Thiruvalluvar University,
Vellore, Tamil Nadu, India

Samuel Tennyson
Department of Zoology, Madras
Christian College, Chennai,
Tamil Nadu, India

Selvaraj Divya
Department of Zoology,
Thiruvalluvar University,
Vellore, Tamil Nadu, India

Shameem Rani
Department of Zoology, M.S.S.
Wakf Board College, Madurai,
Tamil Nadu, India

Grace Marin
Department of Zoology, Scott
Christian College, Nagercoil,
Tamil Nadu, India

Corresponding Author:
Subramanian Arivoli
Assistant Professor,
Department of Zoology,
Thiruvalluvar University,
Vellore, Tamil Nadu, India

GC-MS analysis of bioactive compounds of *Curcuma longa* Linnaeus (Zingiberaceae) rhizome extract

Subramanian Arivoli, Samuel Tennyson, Selvaraj Divya, Shameem Rani and Grace Marin

Abstract

Plants synthesize numerous natural organic compounds having complex chemical structures. Plants that release active compounds have been isolated, purified and employed in a wide range of applications. In the present study, the bioactive compounds of *Curcuma longa* rhizome extracts via GC-MS was analyzed and its biological properties being available in pure form, being nontoxic with a wide spectrum of biological functions, may find its application in the formation of various medicinal products.

Keywords: *Curcuma longa*, rhizome extracts, bioactive compounds

1. Introduction

In India, thousands of plants species are known to have medicinal values. Different parts of plant species are still widely used in traditional Ayurveda and Siddha medicine. More than 60-70% of the rural population still relies on traditional medicine for their primary health care needs. Recently, scientific interest in medicinal plants has burgeoned due to increased efficiency of plant derived drugs and raising concern about the side effects of modern medicine. Today, the use of medicinal plants and their bioactive compounds and the scientific knowledge about them comprises the modern field of phytosciences [1]. Studies are still carried out on the bioactive compound to provide information on sources, its availability according to the season, and the biological properties of the isolated compounds. In the present study, the bioactive compounds were identified from the methanolic rhizome extract of *Curcuma longa* via GC-MS.

2. Materials and methods

2.1. Preparation and screening of phytoextracts

Fresh and healthy rhizomes of *Curcuma longa* were collected in and around of Kasam, Vellore district, Tamil Nadu, India. The rhizomes were washed under running tap water to remove all traces of soil particles and other dirt. It was then air dried for 10-15 days. The rhizomes were then powdered using an electronic blender and sieved to obtain a fine powder. The powdered rhizomes were used for the extraction process. The rhizome powder was extracted using a Soxhlet apparatus [2]. The plant material (1Kg) was soxhleted subsequently with 3L of methanol and the extract was concentrated by evaporation. The yield was used for further analysis.

2.2. Gas Chromatography-Mass Spectrometry (GC-MS)

Clarus 680 GC was used in the analysis employed as a fused silica column, packed with Elite-5MS (5% biphenyl 95% dimethylpolysiloxane, 30 m × 0.25 mm ID × 250µm df) and the components were separated using Helium as carrier gas at a constant flow of 1 mL/min. The injector temperature was set at 260°C during the chromatographic run. The extract (1µL) was injected into the instrument and the temperature was 60 °C (2 min); followed by 300 °C at the rate of 10 °C min⁻¹; and 300 °C, where it was held for six minutes. The mass detector conditions were, transfer line temperature at 240° C; ion source temperature 240 °C; and ionization mode electron impact at 70 eV, a scan time 0.2 seconds and scan interval of 0.1 seconds. The fragments from 40 to 600 Da. The spectrums of the components were compared with the database of spectrum of known components stored in the GC-MS NIST library.

3. Results and Discussion

The bioactive compounds via GC-MS of the methanolic rhizome extract of *Curcuma longa* are presented in Figure 1 and Table 1. Turmeric is one of the largest cash crops in South India particularly in Erode, Coimbatore districts. Turmeric powder contains high concentrations of a potent biological active phytochemical compound curcumin (diferuloyl methane), a substance believed to have health benefits as it gives specific flavor and yellow colour to curry [3]. Besides, it possesses anti-inflammatory [4], antioxidant [5], anti-carcinogenic [6], wound healing [7], anti-diabetic [8], anti-stress [9] and antiviral [10] properties. Bicyclo [4.1.0]-3-heptene, 2-isopropenyl-5-isopropyl-7,7-dimethyl possesses antiprotozoal, antimicrobial, anti-inflammatory, antitumour and chemo preventive activity [11]. Xylopropamine has antipyretic, analgesic, anti-inflammatory, antimicrobial and antioxidant property, whereas 1-(3,3-dimethyl-but-1-ynyl)-1,2-dimethyl-3-methylene-cyclopropane has anti mosquitocidal activity [12].

6-octen-1-yn-3-ol, 3,7-dimethyl acts as a flavouring agent whereas ethyl iso-allochololate has anti-inflammatory, anticancer, antimicrobial, antiasthma and antidiuretic properties [13]. α -curcumene and β -curcumene exhibits hypoglycemic and anti-diabetic activity [14]. Isocurcumenol reveals anti-tumor activity [15]. Curdione possesses antitumour [16], antithrombotic [17], antibacterial and antifungal [18] properties. Comprehensive traditional knowledge on turmeric can be validated by modern pharmacological studies emphasizing the chemical nature of turmeric, its effects on various parameters and detailed studies of the mechanisms of the observed biological actions and molecular study [19]. Keeping in view the afore mentioned biological properties of *Curcuma longa*, it is quite clear that turmeric being available in pure form, being nontoxic with a wide spectrum of biological functions, may find its application in the formation of various medicinal products which can help in the treatment of various diseases in coming future.

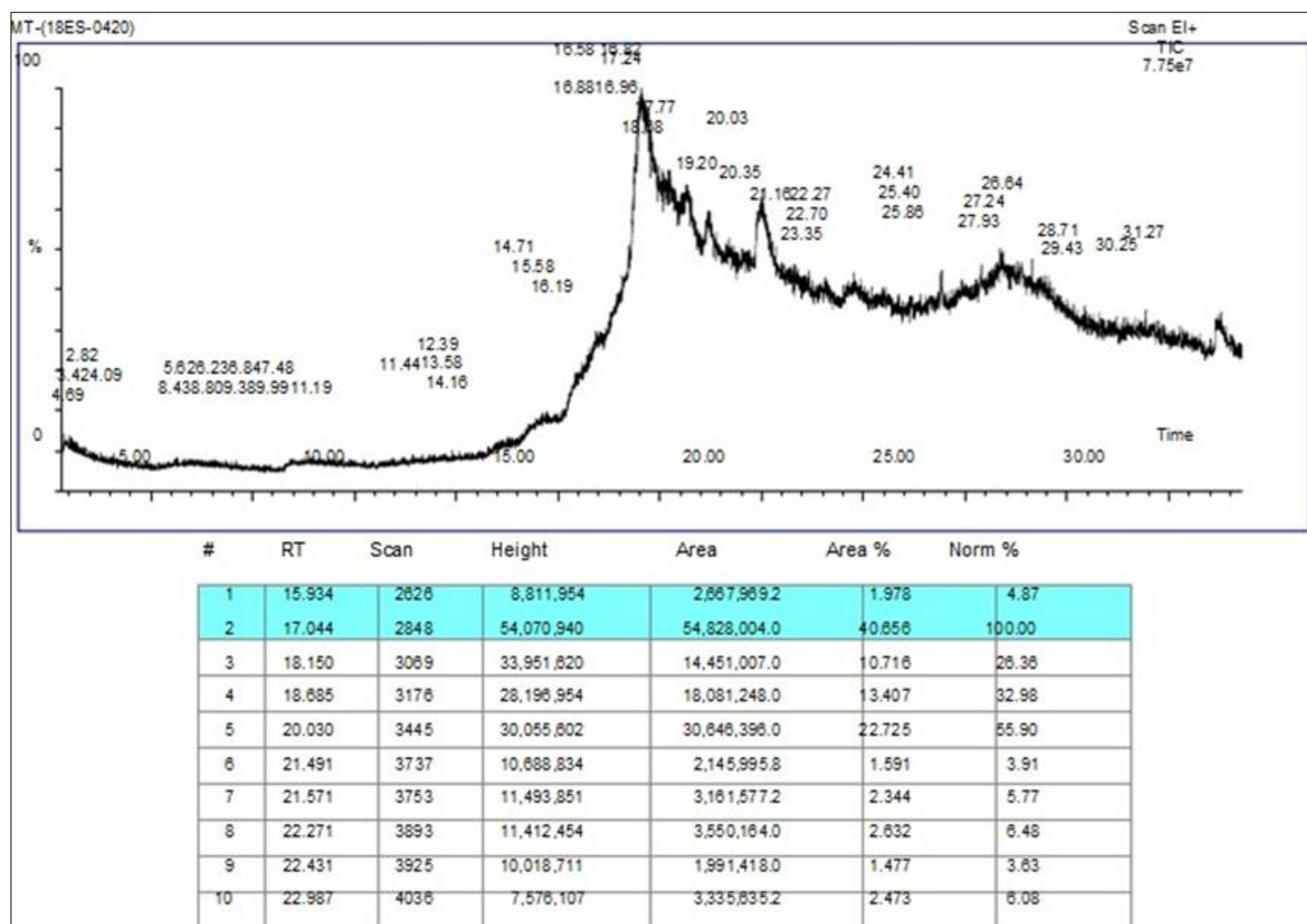


Fig 1: GC-MS analysis of *Curcuma longa* methanolic rhizome extract

Table 1: Bioactive compounds of *Curcuma longa* methanolic rhizome extract

Bioactive compound	Molecular formula (Molecular weight in g/mol)	Structure
Bicyclo[4.1.0]-3-heptene, 2-isopropenyl-5-isopropyl-7,7-dimethyl-	C ₁₅ H ₂₄ (204.35)	

Xylopropamine	$C_{11}H_{17}N$ (163.26)	
1-(3,3-dimethyl-but-1-ynyl)-1,2-dimethyl-3-methylene-cyclopropane	$C_{12}H_{18}$ (162.27)	
6-octen-1-yn-3-ol, 3,7-dimethyl	$C_{10}H_{16}O$ (152.23)	
Ethyl iso-allocholate	$C_{26}H_{44}O_5$ (436.60)	
Curcumin	$C_{21}H_{20}O_6$ (368.40)	
α - curcumene	$C_{15}H_{22}$ (202.33)	
β - curcumene	$C_{15}H_{24}$ (204.75)	
Isocurcumenol	$C_{15}H_{22}O_2$ (234.33)	
Curdione	$C_{15}H_{24}O_2$ (236.35)	

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