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IDENTIFICATION OF BIOACTIVE COMPOUNDS OF *ZINGIBER OFFICINALE* ROSCOE RHIZOMES THROUGH GAS CHROMATOGRAPHY AND MASS SPECTROMETRY

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ABSTRACT
In this study, the bioactive compounds of Zingiber officinale Roscoe rhizomes have been evaluated using GC/MS. The chemical compositions of the methanol extract of Zingiber officinale rhizomes were investigated using thermo gc trace ultra version 5.0, thermo MS DSQ II gas chromatography–mass spectrometry, while the mass spectra of the compounds found in the extract was matched with the National Institute of Standards and Technology (NIST) library. GC/MS analysis of methanol extract of Zingiber officinale rhizomes revealed the existence of Zingiberene (23.69), followed by AR-curcumene (23.69), α-Bergamotene (23.69), Gingerol (14.31), Zingerone (10.07), β-esquiphellandrene (9.94), (Z)-β-Farnesene (9.94), Caryophyllene (9.94) and ç-Elemene (0.72). The results obtained may be helpful to the further study of pharmacological activity for their potential utilization as therapeutic agent.

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Keywords:- *Zingiber officinale,* rhizomes, GC-MS, bioactive compounds. etc.

INTRODUCTION
Zingiber officinale Roscoe is a perennial aromatic plant belongs to the family Zingiberaceae, mostly distributed in East Asia and tropical Australia, the rhizomes of which are used as a spice (Sasikumar, et., al., 2008). Ginger is widely used in various Ayurvedic medicines as an antiemetic, anti inflammatory, antipyretic, analgesic and antiseptic and to treat a variety of conditions including insomnia, baldness, urinary tract infections, and gastrointestinal disorders (Ravindran PN; 1994).

The ginger rhizome contains many useful oils such as steam volatile oil, fixed fatty oil and also other compounds such as pungent compounds, resins, proteins, cellulose, pentosans, starch, gingerol, shogaols, fiber, amino acids and minerals. The pleasant aroma of ginger is due to the presence of more than 70 constituents present in the volatile oil of rhizome. Some of the volatile oils lost by evaporation during drying, therefore, the aroma and flavour of fresh ginger will be different from dry ginger (J.W. Purseglove et al., 1981).

It is consumed worldwide as flavoring agent which is used extensively in food, beverage, and confectionary industries in the products such as marmalade, pickles, chutney, ginger beer, ginger wine, liquors, and other bakery products (Wang X & Zheng ZJ; 2011). Ginger contains 1-2 % oil, which imparts the unique flavour to the spice and it has been studied by man y workers 4-9. Many reports are available on the chemical composition of fresh ginger oil and the naturally occurring flavouring compounds (Sharma et.al; 2002)

The major pungent compounds in ginger have been identified from studies of the lipophilic rhizome extracts and shown to be potentially active gingerols, and their derivatives viz. shogaols, zingerone, and paradol (Akhila A & Tewari R; 1984).

MATERIAL AND METHODS

Collection of plant materials

The fully mature *Zingiber officinale* rhizomes were collected from Brahmpuri, Hingoli District, of Maharashtra, India. The rhizomes were identified and authenticated at Department of Botany, Dnyanopasak College, Parbhani.

Preparation of extracts:

The *Zingiber officinale* rhizomes were first washed well and soil was removed from the rhizomes. Rhizomes were washed several times with distilled water to remove the traces of impurities from the rhizomes. The rhizomes were dried at room temperature and coarsely powdered. The powder was extracted with 70% methanol for 48 hours using soxhlet apparatus. A semi solid extract was obtained after complete elimination of alcohol under reduced pressure. The extract was stored in refrigerator until used. The extract contained both polar and non-polar bio component of the plant material used.

GC –MS analysis:

GC-MS analysis was carried out on THERMO GC - TRACE ULTRA VER: 5.0, THERMO MS DSQ II Gas Chromatography–Mass Spectrometry instrument employing the following conditions: column Elite-1 fused silica capillary column (30 x 0.25mm ID x 1μMdf, composed of 100% Dimethyl polydiloxane), operating in electron impact mode at 70eV; Helium gas (99.999%) was used as carrier gas at a constant flow of 1 ml /min and an injection volume of 0.5 μI was employed (split ratio of 10:1) injector temperature 250 ºC; ion-source temperature 280 ºC. The oven temperature was programmed from 110 ºC (isothermal for 2 min), with an increase of 10 ºC/min, to 200ºC, then 5ºC/min to 280ºC, ending with a 9min isothermal at 280ºC. Mass spectra were taken at 70eV; a scan interval of 0.5 seconds and fragments from 40 to 450 Da. Total GC running time is 36min. min. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas. Software adopted to handle mass spectra and chromatograms was a Turbo Mass Version 5.2.0.

Identification of the Components

The interpretation of mass spectroscopy (GC-MS) was conducted using data base of National Institute Standard and Technology (NIST) having more than 62000 patterns. The spectrum of the unknown component was compared with the spectrum of the known component stored in the NIST library. The retention time, molecular weight, molecular formula and composition percentage of the sample material was recorded and presented in table 1.

RESULTS AND DISCUSSION

The identified compounds of *Zingiber officinale* Roscoe rhizome, their retention time, percentage composition, and are given in Table 1. The total number of compounds identified in methanol extract was 30. The results showed the presence of major compound identified as Zingiberene (23.69), followed by AR-curcumene (23.69), α-Bergamotene (23.69), Gingerol (14.31), Zingerone (10.07), β-esquiphellandrene (9.94), (Z)-β-Farnesene (9.94), Caryophyllene (9.94) and ç-Elemene (0.72). The current results of essential oil compositions of the two varieties are in good agreement with the findings of previous literature, where zingiberene reported the prominent constituents in the fresh ginger (Onyenekwe et al., 1999)

Table No. 01

Sr. No.	Compounds	Molecule Structure	Molecule Weight	Retention Time	Area (%)
1.	2-Butanone, 4-(4-hydroxy-3-methoxyphenyl)- (Zingerone)	$C_{11}H_{14}O_3$	194	23.48	10.07
2.	ç-Elemene	$C_{15}H_{24}$	204	13.86	0.72
3.	1H-Cyclopenta[1,3]cyclopropa[1,2] benzene,octahydro-7-methyl-3-methylene-4-(1-methylethyl)-, [3aS-(3aà,3bá,4á,7à,7aS*)]-	$C_{15}H_{24}$	204	13.63	0.75
4.	Cyclohexene, 3-(1,5-dimethyl-4-hexenyl)-6-methylene-, [S-(R*,S*)]- (β-esquiphellandrene)	$C_{15}H_{24}$,	204	16.27	9.94
5.	Cyclohexene, 1-methyl-4-(5-methyl-1-methylene-4-hexenyl)-,(S)- (Bisabolene)	$C_{15}H_{24}$	204	15.65	2.07
6.	Copaene	$C_{15}H_{24}$	204	13.63	0.75
7.	1,5-Cyclodecadiene, 1,5-dimethyl-8-(1-methylethylidene)-, (E,E)-	$C_{15}H_{24}$	204	13.86	0.72
8.	Caryophyllene	$C_{15}H_{24}$	204	16.27	9.94
9.	1,3-Cyclohexadiene, 5-(1,5-dimethyl-4-hexenyl)-2-methyl-,[S-(R*,S*)]- (Zingiberene)	$C_{15}H_{24}$	204	15.42	23.69
10.	Bicyclo[3.1.1]hept-2-ene, 2,6-dimethyl-6-(4-methyl-3-pentenyl)- (α-Bergamotene)	$C_{15}H_{24}$	204	15.42	23.69
11.	1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylethyl)-, [s(E,E)]- (Germacene D)	$C_{15}H_{24}$	204	13.63	0.75
12.	Naphthalene,1,2,3,4,4a,5,6,8a-octahydro-7-methyl-4-methylene-1-(1-methylethyl)-, (1à,4aá,8aà)-	$C_{15}H_{24}$	204	13.63	0.75
13.	1,6,10-Dodecatriene, 7,11-dimethyl-3-methylene-, (Z)- ((Z)-β-Farnesene)	$C_{15}H_{24}$	204	16.27	9.94
14.	Benzene, 1-(1,5-dimethylhexyl)-4-methyl- (AR-curcumene)	$C_{15}H_{24}$	204	15.42	23.69
15.	1H-3a,7-Methanoazulene, 2,3,4,7,8,8a-hexahydro-3,6,8,8-tetramethyl-,[3R-(3à,3aá,7á,8aà)]-	$C_{15}H_{24}$	204	21.47	1.66
16.	1H-Cycloprop[e]azulene,decahydro-1,1,7-trimethyl-4-methylene-,[1aR-(1aà,4aá,7à,7aá,7bà)]-	$C_{15}H_{24}$	204	13.86	0.72
17.	1H-Cyclopenta[1,3]cyclopropa[1,2] benzene,octahydro-7-methyl-3-methylene -	$C_{15}H_{24}$	204	13.63	0.75

	4-(1-methylethyl)-, [3aS-(3aà,3bá,4á,7à,7aS*)]- (Cubebene)				
18.	6-(p-Tolyl)-2-methyl-2-heptenol	C15H22O	218	27.67	0.87
19.	Cedren-13-ol, 8-	C15H24O	220	27.67	0.87
20.	Caryophyllene oxide	C15H24O	220	25.60	1.11
21.	1-Hydroxy-1,7-dimethyl-4-isopropyl-2,7-cyclodecadiene	C15H26O	222	18.55	0.83
22.	Cyclohexanemethanol,4-ethenyl-à,à,4-trimethyl-3-(1-methylethenyl)-, [1R-(1à,3à,4á)]-	C15H26O	222	17.80	0.96
23.	2-Naphthalenemethanol, decahydro-à,à,4a-trimethyl-8-methylene-, [2R-(2à,4aà,8aá)]-	C15H26O	222	21.21	1.17
24.	Ledol	C15H26O	222	21.21	1.17
25.	Nerolidol 2	C15H26O	222	17.35	1.32
26.	1,6,10-Dodecatrien-3-ol, 3,7,11-trimethyl-, (E)-	C15H26O	222	17.35	1.32
27.	à-Bisabolol	C15H26O	222	21.47	1.66
28.	2,6,10-Dodecatrien-1-ol, 3,7,11-trimethyl-, acetate, (E,E)-	C17H28O2	264	17.35	1.32
29.	9,12-Octadecadienoic acid (Z,Z)-, methyl ester	C19H34O2	294	31.13	0.81
30.	Gingerol	C17H26O4	294	36.59	14.31

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