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A Study of Chemical Compounds in *Rhizophora Apiculata*

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Abstract: Sources of natural antioxidants are primarily plant phenolics, which may occur in all parts of the plants such as fruits, vegetables, nuts, seeds, leaves, roots, and barks. Interest has considerably increased in finding naturally occurring chemical constituents for use in food or medicinal material to replace synthetic chemical. The chemical constituents of leaf, flower and stem samples were analyzed by using Gas Chromatography-Mass Spectrometry (GC-MS). The leaf was found to be rich 2-(2-ethoxyethoxy)ethanol (26.45%) and Kaur-16-ene (3.37%), while 2-(ethoxyethoxy)ethanol (11.08%) and butyl cyclohexyl ester 1,2-Benzenedicarboxylic acid (3.48%) were the main components in the flower. Octadecamethyl cyclononasiloxane (5.24), Kaurene (3.39%) and 1,2,3,4-tetramethoxy-5-(2-propenyl)-benzene (3.26) were the predominant constituents in the stem.

Keywords: *Rhizophora apiculata*, chemical constituents, antioxidants.

1. INTRODUCTION

Rhizophora species are the medical plant species because they are sources of well known and medically useful secondary products include: alkaloids, glycosides, essential oils, and other organic constituents. The most common representatives are *Rhizophora apiculata*, *Rhizophora mucronata* and *Rhizophora mangle* [1]. Loo *et al.* said that sources of natural antioxidants are primarily plant phenolics, which may occur in all parts of the plants such as fruits, vegetables, nuts, seeds, leaves, roots, and barks [2].

Kirtikar and Basu (1935) reported that an alkaline extract from leaf Rhizophora apiculata inhibits the HIV replication and HIV-induced cytopathic effects. The substance responsible for the anti-HIV activity of plant extract is an acid polysaccharide [3]. Mangrove of Rhizophora apiculata tannins consist primarily of condensed tannins or proanthocyanidins [4]. Therefore, attention has been directed towards the development and isolation of natural chemical constituents from plant sources. The compounds were analyzed by using GC-MS [5].

The present work therefore focuses on the *Rhizophora apiculata* as the sample to be analyzed. The objectives of this research are i) to study chemical compounds in Rhizophora Apiculata ii) to determine the chemical compounds present in leaf, flower and stem of Rhizophora Apiculata using GC-MS.

2. EXPERIMENTAL

2.1. Plant Material and Chemical

Leaf, flower and stem samples of *Rhizophora apiculata* were collected from from swamp forest Port Dickson, Negeri Sembilan, Malaysia.

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Methanol, ethyl acetate, and hexane were obtained from J. T. Baker (USA). Whatman No. 1 filter paper was purchased from Sigma (Sigma Aldrich GmbH, Sternheim, Germany). While, double-distilled deionized water of at least 18 MΩ was purified by Nano ultra pure water system (Barnstead, USA).

2.2. Instrumentation

Gas chromatography-mass spectrometry (GC-MS) analyses were performed using a Hewlett-Packard (Palo Alto, CA, USA) gas chromatograph, and equipped with MSD Thermal Aux 2. A HP-Inno Wax capillary column, 30 m long, 0.25 mm internal diameter, and 0.25 μm thickness was used. The column initial temperature was programmed at 50°C (3 min) with an increase of 6°C/min up to 250°C (5 min). Helium was used as the carrier gas. The temperature for injector and detector were 250°C. An injection volume of 1.0 μl was used.

2.3. Component Identification

Components were identified by matching their mass spectra with those recorded in the NIST mass spectral library.

3. RESULTS AND DISCUSSION

The chemical constituents of the flower, stem and leaf of *Rhizophora apiculata* are listed in Table **1**, Table **2** and Table **3**. The analysis of the oils successfully identified six compounds (23.19%) in flower, eight (17.73%) compounds in stem and five compoundss (37.31%) in leaf, , respectively.

From analysis of the three parts of *Rhizophora apiculata,* 2-(2-ethoxyethoxy) ethanol was presented in higher concentration for both leaf and flower component (26.45% and 11.08%, respectively). Meanwhile, Octadecamethyl cyclononasiloxane (5.24%) was predominant in stem sample.

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Table 1. Chemical Constituents of Flower.

No.	t_R (min)	Constituents	Percentage (%)	Probability (%)
1	6.02	Decamethyl cyclopentasiloxane	1.30	90
2	15.64	2-(2-ethoxyethoxy) ethanol	11.08	90
3	17.13	Hexadecamethyl cyclooctasiloxane	2.47	91
4	25.62	1,2,3,4–tetramethoxy – 5-(2 propenyl) benzene	3.44	93
5	29.46	benzophenone	1.42	93
6	30.34	Butyl cyclohexyl ester 1,2- Benzenedicarboxylic acid	3.48	86
		Total (%)	23.19	

Table 2. Chemical Constituents of Stem.

No.	t_R (min)	Constituents	Percentage (%)	Probability (%)
1	6.02	Decamethyl cyclopentasiloxane	1.09	90
2	20.06	Octadecamethyl cyclononasiloxane	0.42	81
3	22.49	Pi–cyclopentadienyl-dicarbonyl-ethylisonitril – trichlorgermyl - tungsten	1.33	94
4	22.57	Eicosamethyl cyclodecasiloxane	2.25	76
5	25.62	1,2,3,4 –tetramethoxy – 5-(2 propenyl) benzene	3.26	93
6	27.93	Kaurene	3.39	89
7	29.46	Benzophenone	0.75	83
8	33.48	Octadecamethyl cyclononasiloxane	5.24	76
		Total (%)	17.73	

Table 3. Chemical Constituents of Leaf.

No.	t_R (min)	Constituents	Percentage (%)	Probability (%)
1	15.64	2-(2-ethoxyethoxy) ethanol	26.45	72
2	17.13	Hexadecamethyl cyclooctasiloxane	2.67	83
3	24.95	3,4 diethylphenol	1.61	83
4	27.93	Kaur – 16-ene	3.37	86
5	29.46	benzophenone	3.21	93
		Total (%)	37.31	

4. CONCLUSION

The analysis of leaf was found to be rich 2-(2-ethoxyethoxy)ethanol (26.45%) and Kaur-16-ene (3.37%). 2-(ethoxyethoxy)ethanol (11.08%) and butyl cyclohexyl ester 1,2-Benzenedicarboxylic acid (3.48%) were the main components in the flower. Octadecamethyl cyclononasiloxane (5.24), Kaurene (3.39%) and 1,2,3,4- tetramethoxy-5-(2-propenyl)-benzene (3.26) were the predominant constituents in the stem. As the results, these findings can give additional information about the species and can be used to distinguish the different components of *Rhizophora apiculata*.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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