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Energy-Dispersive X-Ray Microanalysis of Elements' Content of Medicinal Plants Used Traditionally as Anticancer Cure

[1]Siddig Ibrahim Abdel-Wahab, [1]Nooraini Mohd Ain, [1]Ahmad Bustamam Abdul,
[1]Manal Mohamed Elhassan and [2, 3]Tengku Azmi Tengku Ibrahim
[1]UPM-MAKNA Cancer Research Laboratory, Institute of Bioscience,
[2]Unit of Microscopy, Institute of Bioscience,
[3]Department of Preclinical Sciences, Faculty of Veterinary Medicine,
University of Putra Malaysia, Serdang, 43400, Selangor, Malaysia

Abstract: This present study aims to investigate, the elemental analysis of some medicinal plants used traditionally as anticancer cure by local Malaysians. Element's content of these plants was carried out using Energy Dispersive X-ray Microanalysis combined with Variable Pressure Scanning Electron Microscope microanalysis (EDX). In this study, elements' contents from the leaves of *Goniothalamus umbrosus*, *Kaempferia galangal*, *Gynura procumbens*, *Morinda citrifollia*, *Lawsonia inermis* and *Baringtonia racemosa* using EDX technique. The elemental distribution revealed the presence of C, O, Mg, P, S, Cl, K, Ca, Al, Si and Fe, in anti-cancer medicinal plants and their relative weight percentages were estimated. These elements may be responsible for the biomedicinal properties of these plants, which based on anticancer properties. This supports the traditional usage of these plants as anti-tumor.

Key words: Anticancer plants, element analysis, energy-dispersive X-ray microanalysis

INTRODUCTION

The use of plants as the preferential treatment for cancer has been known for centuries. Today, there has been approximately 3000 plant species that has been identified to possess anticancer properties. This historical information was utilized by modern scientists in search for better compounds as anti-cancers. The search for anti-cancer agents from plant sources started in earnest in the 1950s with the discovery and development of the vinca alkaloids, vinblastine and vincristine and the isolation of the cytotoxic podophyllotoxins (Gordon and David, 2005). The >60% of anti-cancer agents currently used are derived from natural sources, which include the plant kingdom and marine organisms (Siddiq and Dembitsky, 2008) and also micro-organisms (Gordon and David, 2005).

Current research in drug discovery from medicinal plants involves a multifaceted approach combining botanical, phytochemical, biological and molecular techniques. In traditional methods, medicinal plants are being used, which contain both organic and inorganic constituents (Aligiannis *et al*., 2001). Therefore, to correlate the chemical and biological properties of medicinal plants, many of these techniques have been applied. In this respect, the current study was conducted to investigate the elemental contents (C, O, Mg, P, S, Cl, K, Al, Ca, Si and Fe) of *Goniothalamus umbrosus*, *Kaempferia galangal*, *Gynura procumbens*, *Morinda citrifollia* L., *Lawsonia Inermis* and *Baringtonia racemosa* (Table 1) using variable pressure scanning electron microscope microanalysis (EDX).

Table 1: Common malay names and of medicinal plants analysed and their traditional use

Species (family)	Common name	Used in traditional medicine (Leaf)	Some reported anticancer activities
Goniothalamus umbrosus	Kenerak	Used in Abortifacient	Anticancer (Induce apoptosis) (Lee *et al*., 2003)
Kaempferia galanga	Cekur	Used to relieve sore throats, fever, swelling, rheumatism and sore eyes.	Antitumor (Kirana *et al*., 2003)
Gynura procumbens	Sambung nyawa	Used in blood glucose and hypertension.	Antiproloferative and antipyretic (Lee *et al*., 2007)
Morinda citrifollia	Mengkudu	Used to relieve a fever, dysentery and diarrhea	Anti-tumor and anti-inflammatory (Wang and Su, 2002)
Lawsonia Inermis	Inai	Used to treat skin inflammation, abscesses, bruises, scurvy affections, leprosy and rheumatism.	Anticarcinogenic and antioxidant (Endrini *et al*., 2002)
Baringtonia racemosa	Putat kampung	Used to treat nose ulcers, coughs, asthma, diarrhea, pruritus and chickenpox	Anti-tumor and toxicity (Thomas *et al*., 2002)

Corresponding Author: Nooraini Mohd Ain, UPM-MAKNA Cancer Research Laboratory, Institute of Bioscience, University of Putra, Serdang, 43400, Selangor, Malaysia

MATERIALS AND METHODS

Plants samples: Fresh leave samples of traditional anti-cancer plants-*Goniothalamus umbrosus*, *Kaempferia galangal*, *Gynura procumbens*, *Morinda citrifollia* L., *Lawsonia Inermis* and *Baringtonia racemosa*-were collected from the Biodiversity Unit, Institute of Bioscience, Universiti Putra Malaysia. Plants were identified by Mr. Tajuddin Abd Manap, Assistant Agriculture Officer, Unit of Biodiversity, IBS, UPM, Malaysia.

Energy dispersive X-ray microanalysis: Energy Dispersive X-ray Microanalysis has been applied before to determine elements' content of plants (Obiajunwa *et al*., 2002; Slavica *et al*., 2005). Samples were cut into 1×1 mm and mounted on Aluminium stub specimen holders and viewed under a Variable Pressure Scanning Electron Microscope microanalysis (VPSEM, EDX) model LEO 1455 with an Oxford INCA EDX 300 attachment. Samples were examined at an accelerating voltage of 20 kV. For such analysis, three spectra from each sample were acquired for 120 sec with process time number 5. This experiment was conducted at the Microscopy unit, IBS, UPM, Malaysia.

RESULTS AND DISCUSSION

This study was intended to examine the elements' content of some Malaysian plants, namely known as *Goniothalamus umbrosus*, *Kaempferia galangal*, *Gynura procumbens*, *Morinda citrifollia*, *Lawsonia Inermis* and *Baringtonia racemosa*. These plants are being used frequently as traditional healing for cancer. Elements analysis was performed using Energy Dispersive X-ray Microanalysis combined with Variable Pressure Scanning Electron microscope microanalysis (EDX).

Biological materials have been extensively analyzed for their elements' content using different techniques by many authors (Ekinci and Sahin, 2002). It is considerable to quantify the element's content of remedial plants (Balunasa and Kinghorn, 2005; Oliveira *et al*., 2006). For this reason, reliable analyses will help to clarify and define the effective. The most important advantages of energy dispersive X-ray for the quantitative and qualitative analysis are: Simultaneous determination of many elements, Determination in a wide concentration range, Simple and fast sample preparation and much lower equipment cost than that of a conventional wavelength X-ray fluorescence spectrometer, especially when, a radioisotope is used instead of X-ray tube (Ekinci and Sahin, 2002).

As depicted in Table 2, the elemental content of the medicinal plant analyzed. Apart from carbon and oxygen, all the anticancer plants contain potassium and chlorine. The percentage of magnesium in, *Goniothalamus umbrosus Kaempferia galangal* and *Gynura procumbens* was the highest amongst all tested plants. Some researchers have reported that magnesium may play a role as antioxidant in preventing cancer. Result obtained from this study also, showed that calcium is present in all the anticancer plants except *Baringtonia racemosa*. The study by Garland *et al*. (1999) showed that intake of calcium combined with vitamin D is effective in preventing breast and colon cancers. The data also, showed that *Goniothalamus umbrosus* and *Kaempria galangal* contain iron, an essential oxygen-carrying element-hemoglobin, in red blood cells and myoglobin in muscles. It is also, a component of various enzymes and is concentrated in bone marrow, liver and spleen. Fukuda *et al*. (2004) reported that there is relationship between excessive intake of iron and cancer.

Table 2: Mineral contents (weight %) of the anticancer plants analyzed

Elements	*Goniothalamus umbrosus*	*Kaempferia galanga*	*Gynura procumbens*	*Morinda longifolia*	*Lawsonia Inermis*	*Baringtonia racemosa*
C	77.17%	26.43%	44.36%	46.81%	47.86%	22.21%
O	18.15%	68.21%	39.92%	51.86%	38.67%	76.15%
Mg	0.19%	0.39%	0.4%	nd	0.15%	nd
P	nd	nd	0.4%	nd	nd	0.25%
S	0.11%	nd	0.39%	0.13%	0.27%	0.23%
Cl	0.87%	0.11%	3.63%	0.12%	4.78%	0.1%
K	1.43%	1.03%	8.7%	0.45%	8.27%	1.05%
Al	nd	nd	0.06%	0.16%	nd	nd
Ca	1.723%	0.65%	1.73%	0.47%	0.5%	nd
Si	nd	2.64%	nd	nd	nd	nd
Fe	0.2%	0.54%	nd	nd	nd	nd

nd: not detected

CONCLUSION

Mineral analysis of leaves of some anti-cancer plants using EDX microanalysis showed the presence of C, O, Mg, P, S, Cl, K, Ca, Al, Si and Fe. At this juncture the minerals in these anti-cancer plants can be considered as potential sources of nutritional element until their active principles identified and mechanism of action in the preventing or combating cancer as locally claimed is fully elucidation.

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