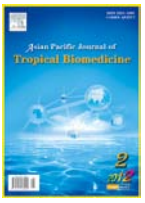
Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Biomedicine

journal homepage:www.elsevier.com/locate/apjtb



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Determination of some minerals and trace elements in two tropical medicinal plants

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ARTICLE INFO

Article history:
Received 18 May 2012
Received in revised form 21 May 2012
Accepted 15 August 2012
Available online 20 August 2012

Keywords:
Syzygium caryophyllatum
Syzygiumm densiflorum
Minerals
Trace elements
Atomic absorption spectrophotometer

ABSTRACT

Objective: To determine the minerals, Iron (Fe), Sodium (Na), Potassium (K), Manganese (Mn) and trace elements, Lead (Pb), Copper (Cu), Cadmium (Cd) and Zinc (Zn) in two tropical medicinal plants (*Syzygium caryophyllatum* and *Syzygium densiflorum*). **Methods:** All the elements were determined by using atomic absorption spectrophotometer (AAS). **Results:** The average concentrations of Fe, Zn, Cu, Mn, Pb and Cd detected in leaves of *Syzygium caryophyllatum* and *Syzygium densiflorum* were 99.275±0.022, 17.302±0.010, 45.498±0.072, 47.344±0.021, 7.634±0.050, 0.253±0.003 and 93.829±0.015, 17.412±0.064, 64.866±0.058, 31.777±0.051, 6.768±0.010 and 0.343±0.004, respectively. **Conclusions:** The mineral contents in the medicinal plants are at different levels. Therefore, these medicinal plants are rich in some essential elements and very least amount in trace elements, especially Fe and Mn which are essential for human health.

1. Introduction

Syzygium caryophyllatum and *Syzygium densiflorum* belongs to myrtaceae family. It is large, evergreen tree and grows up to 15 m tall in high elevation. It grows only in South Western Ghats of India in particular, Palni Hills, Anaimalai and Nilgiri[1]. Hence, it is an endemic population. The *Syzygium* species having appreciable medicinal properties have drawn the attention of the researchers in recent times. Many pharmacological studies have been carried out in different *Syzygium* species. Antimicrobial activities[2,3], antifungal, antitumor, antihyperglycemic, antihyperlipidemic, antioxidant, antidiabetic and antigastric ulcer activities of *Syzygium cumini* and *Eugeina jambolana* extracts[4-10], cyctotoxicity of *Syzygium samarangense*[11,12], superoxide anion radical scavenging activity of *Syzygium aromaticum* buds[13], antioxidant activities of *Syzygium aqueum*[14], oxygen radical absorbance, total reducing capacity and ferric reducing power of *Syzygium anisatum*[15], antiulcerogenic activities of *Syzygium jambos*[16] and superoxide radical and hydroxyl radical scavenging activities of *Syzygium aromaticum* buds[17] have been studied. Recently, *Syzygium cumini* and *Syzygium jumbo* leaves extracts are used for synthesis of silver nanoparticles[18,19].

Essential, trace elements and minerals in Indian medicinal plants have been investigated by many researchers to strengthen the importance of elemental analysis with respect to human health[20-23]. Several attempts have been made to determine of the macro and micro-nutrient contents of herbal, medicinal and aromatic plants from many countries all over the world. The human body requires a number of minerals in order to maintain good health. A number of minerals essential to human nutrition are accumulated in different parts of plants as it accumulates minerals essential for growth from the environment[24]. Trace elements play a very important role in the formation of the active chemical constituents present in medicinal plants and these are responsible for their medicinal as well as toxic proprieties. Since, there is no report on elemental levels of *Syzygium caryophyllatum* and *Syzygium densiflorum* leaves, we report for the first time on the minerals and trace elements in these plants.

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2. Materials and methods

2.1. Reagents

Nitric acid and hydrochloric acid (Merck, India) were used as received. Standard sample solutions of Fe, Zn, Cu, Mn, Pb, Cd, Na and K (1 000 mg/mL) were obtained from Merck (Germany). All the solutions were prepared from triply distilled water. All the reagents used were of analytical grade.

2.2. Plant materials

The leaves of *Syzygium caryophyllatum* and *Syzygium densiflorum* leaves were collected in January 2010 from Palni Hills with the help of Palni Hills Conservation Council (NGO), Kodaikanal, Tamil Nadu, India.

2.3. Sample preparation for elemental analysis

The glassware and polyethylene containers were washed with tap water, then soaked over night in 6N HNO_3 solution and rinsed several times with ultra pure water to eliminate absorbance due to detergent[25]. The standard procedure described in AOAC[26] was followed for the preparation of samples for analysis of heavy metals and minerals. Accurately weighed (2.0 g) plant samples were transferred into a silica crucible and kept in a muffle furnace for ashing at 450 ℃ for 3 hours and then 5 mL of 6 M HCl was added to the crucible. Then, the crucible containing acid solution was kept on a hot plate and digested to obtain a clean solution. The final residue was dissolved in 0.1 M HNO_3 solution and made up to 50 mL. Working standard solutions were prepared by diluting the stock solution with 0.1 M nitric acid for checking the linearity.

2.4. Determination of elements

Various essential and trace elements such as Fe, Zn, Cu,Mn, Pb, Cd, Na and K in plant samples were analyzed using atomic absorption spectrophotometer (AA 6300, Shimadzo, Japan) equipped with flame and graphite furnace. Air–acetylene flame was used for determination of metal content. The instrument was operated with the following conditions in flame mode: acetylene 2.0 L/min, air 15 L/min, the inert argon gas flow and the temperature parameters were followed as recommended by manufacturer. The absorption wavelength for the determination of each metal together with its linear working range and correlation coefficient of calibration graphs are given in Table 1. Data were rounded off suitably according to the value of standard deviation from measurements in triplicate.

2.5. Statistical analysis

Results of the research were analysed for statistical significance by ANOVA. This research was performed by three duplicates with a replicate.

3. Results

The mean concentration levels of elements in two tropical medicinal plants are summarized in Table 2. A perusal

Table 1.
Operating parameters for working elements

Elements flow	Wavelength(nm)	Lamp intensity (nm)	Slit coefficient	width Correlation(mA)	Flame(L/min)	Fuel gal(*r*)
Fe	248.3	12	0.2	1.000 0	Air–C_2H_2	1.8
Zn	213.9	8	0.7	0.999 9	Air–C_2H_2	2.0
Cu	324.8	6	0.7	0.997 0	Air–C_2H_2	1.8
Mn	280.1	10	0.2	0.997 5	Air–C_2H_2	2.0
Pb	283.3	10	0.7	0.999 1	Air–C_2H_2	2.0
Cd	228.8	8	0.7	0.995 7	Air–C_2H_2	1.8
Na	279.5	10	0.2	0.973 5	Air–C_2H_2	2.0
K	766.5	10	0.7	0.871 3	Air–C_2H_2	2.0

Table 2.
Essential and trace elements in leaves.

Elements(mg/kg)	*Syzygium caryophylatum*	*Syzygium densiflorum*
Fe	99.275 ± 0.022	93.829 ± 0.015
Zn	17.302 ± 0.010	17.412 ± 0.064
Cu	45.498 ± 0.072	64.866 ± 0.058
Mn	47.344 ± 0.002	31.777± 0.051
Pb	7.634 ± 0.050	6.768 ± 0.010
Cd	0.253 ± 0.003	0.343 ± 0.004
Na	Nil	Nil
K	Nil	Nil

of data in Table 2 showed that the mineral contents in analyzed in these plants are in narrow range. The elemental compositions in both plants are almost in equal range. The Na and K contents in both plant were absent.

4. Discussion

Slightly highest amount of Fe is found in *Syzygium caryophyllatum* as compared with *Syzygium densiflorum*. The amount of Zn present in both plants is approximately same. Whereas the Cu content of *Syzygium densiflorum* is slightly higher than that of *Syzygium caryophyllatum*. Similarly, higher content of Mn is found in *Syzygium caryophyllatum* as compared with *Syzygium densiflorum*. But the amount of Pb and Cd present in both plants is almost same. Particularly the Cd content is very less in these plants. These two plants are populated in same location at Palni Hills at high elvation which is totally free from pollution. Absence of Na and K in both plants may be due to environmental factor. Adequate iron in a diet is very critical for decreasing the incidence of anaemia[27]. Zn is an essential metal for the normal functioning of various enzyme systems. Zn deficiency, particularly in children, can lead to loss of appetite, growth retardation, weakness, and even stagnation of sexual growth. Mn is found both as a structural component of some enzymes and as an activator of others[28]. The World Health Organization has recommended an intake of Mn of 2-9 mg/day for an adult[29,30]. Copper deficiency in human may result in hypochromic, microcytic anemia, and neutropenia and bone changes[31]. Lead and cadmium have no roles to play in metabolism. Although lead was found in slight excess, cadmium was not detected up to ppm levels. Both Pb and Cd are present below the threshold limit in the entire sample; the intake of these leaves may not affect the human health[32]. Various investigators have addressed the levels of essential, non essential, micro and macro elements from various medicinal plants, vegetables, fruits, spices and food items[33,34]. All the elements are found to be below the recommended tolerable levels proposed by Joint FAO/WHO Expert Committee on Food Additives[35]. As stated in introduction, *Syzygium* species are more medicinally important. Hence determination of elements in these plants is also important. This is the first report on mineral and trace elements in *Syzygium caryophyllatum* and *Syzygium densiflorum* leaves.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

We thank Prof. D. Gunasekar, Department of Chemistry, Sri Venkataswara University, Tirupati, India for suggesting the plants. The authors are grateful to The Director and staff of Palni Hills Conservation Council (Non-profit NGO), Kodaikanal, Tamil Nadu, India for providing plant materials.

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