

Quantitative estimation of macro, micro nutrients and trace elements by X-ray fluorescence Spectroscopy (XRF) from *Aglaia lawii* (white).

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Abstract: - Ayurveda reports use of herbal medicines and metal salts in the treatment of various diseases. Elements play an important role in metabolism in human body. *Aglaia lawii* (white) is a medicinal plant belongs to Meliaceae family. Stem, bark, leaves, flowers, and fruits of this plant are used in Ayurvedic preparations to cure fever, diarrhea, inflammation and wounds etc. Literature survey reveals that very few reports of chemical analysis of this plant are available. Metals play an important role in the metabolism. The deficiency or excess of trace elements lead to various complications and metabolic disorders in human being. The present work includes quantitative determination of various elements from the leaves of *Aglaia lawii* by using x-ray fluorescence technique (XRF). The result indicate the presence of K, Ca, Si as macro elements, Mg, Fe, Co, Cr, Cu, Ni micro elements and Ti, Mn as trace elements. Quantitative amount of these elements is noted.

Keywords: - *Aglaia lawii* (White), XRF, calcium, Iron, Manganese.

Introduction:

Natural products are used as traditional medicines from ancient times. They are having a great importance in Ayurveda. Ayurveda defines a drug as any substance or product, which can be used to modify physiological system or pathological state for the benefit of the recipient. The word Ayurveda is derived from “Ayur” meaning life and “Veda” meaning science. Thus Ayurveda means science of life¹. It is presumed that the knowledge of Ayurveda is given by the gods. It is accepted as the oldest written medicinal system that is also supposed to be

more effective in certain cases than modern therapies².

Aglaia is a genus of more than 100 species belonging to the Mahogany family (Meliaceae). These trees occur in the tropical and subtropical forests of Southeast Asia, Northern Australia and the Pacific. Some are important trees, others have edible fruits, scented flowers, or medicinal properties. Many have complex biological relationships with their dispersal agents. Some show insecticidal bioactivity.³ More than fifty species are available in India of which *Aglaia lawii* predominantly grows as a weed tree in Maharashtra as in Kolhapur, Nasik,

Pune, Raigad, Ratnagiri, Satara, Sindhudurg, Thane etc.⁴ Certain species of *Aglaia* have traditionally been used for their medicinal and healing properties such as the treatment of fever, diarrhea, inflammation and wounds. Extracts have also been used as bactericides, insecticides and in perfumery.⁵ *Aglaia lawii* is distributed from India, through Burma (Myanmar), Thailand, Indo-China and throughout Malaysia towards the Solomon Islands.⁶ ⁷ It is a medium sized to fairly large tree which can reach up to 40m tall. The wood is reported as hard and durable ⁷. *Aglaia Lawii* is a traditional medicinal plant having been used for the treatment of bacterial infection, liver, tumour diseases and headaches.⁸ Its medicinal properties have yet to be studied systematically and scientifically. The deficiency or excess of trace elements lead to various complications and metabolic disorders in human being. The present work includes quantitative determination of various elements from the leaves of *Aglaia lawii* by using x-ray fluorescence technique (XRF). The elemental compositions present in the medicinal plants have great importance to understand their functions in the human body⁹.

Phosphorous is tied to calcium in bone structure and plays a significant role in CNS function. Many enzymes contain as a base phosphoproteins. Phospholipids are involved in nerve conduction. Phosphate is the primary iron in extracellular and intracellular fluid; it aids absorption of dietary constituents, helps to maintain the blood at a slightly alkaline level, regulatory enzyme activity and is involved in the transmission of nerve impulses ^{10, 12}. Potassium is important, mainly in the intercellular fluid as the primary ion. Potassium together with sodium helps to regulate the water balance within the body. It regulates the transfer of nutrients to the cell, transmits electrochemical impulses and is necessary for normal growth enzymatic reactions etc^{10, 11}. Calcium is used in the development and maintenance of bone structure. It plays function in the clotting process, nerve transmission, hormone function and metabolism of vitamin D etc.

Manganese deficiency cause skeletal abnormalities, retarded bone growth, change in hair colour to growth, abnormalities in pancreas, and disturbances in lipid and carbohydrate metabolism¹⁰.

Iron plays a significant role in oxygen transport in the body. A deficiency of Iron can impair neuronal development. Iron deficiency results in sweating, rapid pulse, prolonged sleep, cessation of the menses, aversion to eating and heavy feeling of body ^{10, 12}. Zinc deficiencies are associated with mental impairments. Zinc deficiency may be associated with mental lethargy, emotional disorder and irritability^{10,13}. Copper is an important mineral in dopamine synthesis. Low level of dopamine results in decrease in activity of central nervous system. A deficiency of copper may cause hypertension, antibiotic sensitivity, hyperactivity, hyperglycemia, manic disorders insomnia, allergies and osteoporosis ^{10, 11,12}. Silicon in plants provides structural support and improves tolerance to diseases, drought and metal toxicity¹⁰.

Magnesium is a key element in cellular metabolism. For high metabolic rate, cells require high magnesium. In presence of higher percentage of potassium and phosphorous, absorption of magnesium increases. As magnesium is a natural sedative, it makes the person feel sleepy. Loss of magnesium leads to hyper – irritability. Adults may suffer muscles tremors, memory loss, inability to concentrate, apathy and depression. ^{10, 11}. Sodium maintains the acid alkali (pH) balance in the body. It is necessary to maintain electrical Potentials of the nervous system. Deficiency of sodium may cause diarrhea, vomiting and excessive sweating, nausea, dizziness poor concentration, cramps confusion, dehydration, depression and muscle weakness ^{10, 12}. Thus *Aglaia lawii* (white) leaves can be used to overcome these deficiencies, as these are not only a rich source of phosphorous, silicon and manganese but also provides other micronutrients like calcium, sodium, iron, zinc, magnesium, copper, and potassium.

Table-1: Element Contents of *Aglaia lawii* leaves

Sr. no	Elements	percentage
1	Potassium	2.711
2	Calcium	2.378
3	Magnesium	0.2629
4	Chlorine	0.1283
5	Phosphorus	0.145

6	Sulfur	0.2119
7	Aluminum	0.0705
8	Iron	0.07503
9	Sodium	<0.010
10	Copper	0.0007
11	Lanthanum	<0.00020
12	Zinc	0.00196
13	Cesium	<0.00040
14	Barium	0.00034
15	Manganese	0.00509
16	Strontium	0.000489
17	Rubidium	0.00099
18	Silicon	0.5804
19	Vanadium	<0.00073
20	Bromine	0,00271
21	Tin	0.00086
22	Tellurium	0.00091
23	Iodine	0.00081
24	Cobalt	<0.00030
25	Erbium	<0.00051
26	Chromium	<0.00028
27	Antimony	<0.00084
28	Titanium	0.01091
29	Nickel	0.00025
30	Yttrium	0.00008
31	Molybdenum	0.00019
32	Hafnium	0.0002
33	Lead	0.00026
34	Silver	0.00115
35	Cerium	0.00293
36	Ytterbium	<0.00020
37	Thorium	0.00017
38	Tungsten	0.00006
39	Cadmium	0.00054
40	Uranium	0.00015
41	Bismuth	<0.00010
42	Zirconium	<0.00010
43	Niobium	<0.000030
44	Tantalum	0.00028
45	Selenium	0.00018
46	Mercury	<0.00010
47	Thallium	<0.00010
49	Germanium	<0.00005
50	Arsenic	<0.00005

Experimental:

The plant material was collected from Mulshi district of Pune, Maharashtra, India. It was authenticated from Botanical survey of India, Pune, Maharashtra, India. Its Authentication No. is BSI/WRC/Tech/2010/1028. Pune, India.

The air shade dried leaves material of *Aglaia lawii* was pulverized and put for elemental analysis. The instrument AMETEK SPECTRO XEPOS, XRF was used. The macro elements refer to the main elements that are required by the plants for their basic functions. Microelements are also known as trace elements. The total fifty elements were detected. They were composed of macro elements, microelements, trace elements & heavy elements. The details are reported (Table-1).

Results and Discussion:

The elemental compositions present in the medicinal plants have great importance to understand their functions in the human body. Phosphorous, Potassium, Calcium, Iron, Zinc, Manganese, Magnesium, Silicon are the chief elements that contribute to the metabolism in human body and affect the total health to a remarkable extent. In this study, the concentrations of fifty elements were determined in the leaves part of *Aglaia lawii* by using XRF spectroscopy. The result showed various concentrations of Five macro elements: K, Ca, Mg, Si, P. Twenty-seven microelements (trace elements): Cl, Ti, Na, Al, S, V,

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Ga, Ge, Se, Br, Rb, Sr, Y, Zr, Nb, Mo, I, Cs, Ba, La, Er, Yb, Hf, Ta, W, Tl, Th. Eighteen heavy elements: Cr, Co, Ni, Cu Zn, As Ag Cd, Sn, Sb, Te, Mn, Fe, Ce, Hg, Pb, Bi, U..The analysis indicated the higher concentration of K, Ca, Mg, Si, P elements.

Thus *Aglaia lawii* (white) leaves can be used to overcome these deficiencies, as these are not only a rich source of phosphorous, silicon and magnesium but also provides other micronutrients like calcium, sodium, iron, zinc, magnesium, copper, and Manganese.

Conclusion:

The above results indicate that the *Aglaia lawii* leaves are a good source of essential nutrients required for the well being of human body. The presence of potassium, phosphorus, iron, calcium, magnesium, copper etc. in high concentration in the Leaves of *Aglaia lawii* suggests its use in therapeutic purposes. Thus the presence of the nutraceutically valued minerals in the plant points toward the possibility of their use to restore the different imbalances caused in the body.

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