Investigation Of Elemental Concentration In Neem Tree

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***Abstract*— Leaves, barks and roots of the Neem tree were collected in front of the Department of Engineering Physics, Technological University (Mandalay) at Patheingyi Township, Mandalay Region. After sample preparation they were analysed by Shimadzu EDX-7000 spectrometer using Fundamental Parameter (FP balance) method. In leaves sample it was found that calcium was the largest concentrated element, and potassium, sulphur and strontium were the second largest ones. Iron, copper, titanium, manganese, bromine, zinc and rubidium were found as trace elements. The same largest element concentration in neem barks was calcium. The second largest elements were potassium, sulphur and iron. Strontium, titanium, copper, manganese and zinc were observed as trace elements. The most prominent element was also calcium in neem roots sample. Potassium, sulphur and iron were the second largest ones. Strontium, titanium, manganese, copper and zinc were trace elements. The uses of neem tree parts and its elements were discussed.**

***Keywords* : Neem tree, Energy Dispersive X-ray Fluorescence, EDX-7000, FP balance, Concentration**

I. INTRODUCTION

Azadirachtaindica, commonly known as **neem**, **nimtree** or **Indian lilac**, is a tree in the mahogany family Meliaceae. It is one of two species in the genus *Azadirachta*, and is native to the Indian subcontinent, i.e. India, Nepal, Pakistan, Bangladesh, Sri Lanka, and Maldives. It is typically grown in tropical and semi-tropical regions. Neem trees also grow in islands located in the southern part of Iran. Its fruits and seeds are the source of neem oil. Neem is a Hindi noun derived from Sanskrit Nimba.

Neem is a fast-growing tree that can reach a height of (15 – 20 m), and rarely (35 – 40 m). It is evergreen, but in severe drought it may shed most of its leaves or nearly all leaves. The branches are wide and spreading. The fairly dense crown is roundish and may reach a diameter of (20 – 25 m). The neem tree is very similar in appearance to its relative, the Chinaberry (*Meliaazedarach*).

The opposite, pinnate leaves are (20 – 40 cm), long, with 20 to 31 medium to dark green leaflets about (3 – 8 cm) long. The terminal leaflet is often missing. The petioles are short.

The (white and fragrant) flowers are arranged in more-or-less drooping axillary panicles which are up to25 cm long. The inflorescences, which branch up to the third degree, bear from 250 to 300 flowers. An individual flower is (5 – 6 mm) long and (8 –11 mm) wide. Protandrous, bisexual flowers and male flowers exist on the same individual tree.

The fruit is a smooth (glabrous), olive-like drupe which varies in shape from elongate oval to nearly roundish, and (1.4 – 2.8 cm) by (1.0 –1.5 cm) when it is ripe. The fruit skin (exocarp) is thin and the bitter-sweet pulp (mesocarp) is yellowish-white and very fibrous. The mesocarp is (0.3 – 0.5 cm) thick. The white, hard inner shell (endocarp) of the fruit encloses one, rarely two, or three, elongated seeds (kernels) having a brown seed coat.

The neem tree is often confused with a similar looking tree called bakain. Bakain also has toothed leaflets and similar looking fruit. One difference is that neem leaves are pinnate but bakain leaves are twice- and thrice-pinnate. Its fruit are shaped like miniature apples.

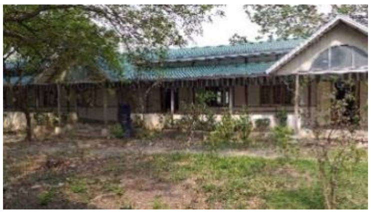
The neem tree is noted for its drought resistance. Normally it thrives in areas with sub-arid to sub-humid conditions, with an annual rainfall of (400 – 1,200 mm). It can grow in regions with an annual rainfall below 400 mm, but in such cases it depends largely on ground water levels. Neem can grow in many different types of soil, but it thrives best on well drained deep and sandy soils. It is a typical tropical to subtropical tree and exists at annual mean temperatures of (21 – 32 °C),(70 – 90 °F). It can tolerate high to very high temperatures and does not tolerate temperature below 4 °C (39 °F).Neem is one of a very few shade-giving trees that thrive in drought-prone areas e.g. the dry coastal, southern districts of India, and Pakistan. In India and tropical countries where the Indian diaspora has reached, it is very common to see neem trees used for shade lining streets, around temples, schools and other such as public buildings or in most people's back yards. In very dry areas the trees are planted on large tracts of land.

Neem is considered a weed in many areas, including some parts of the Middle East, most of Sub-Saharan Africa including West Africa and Indian Ocean states, and some parts of Australia. Ecologically, it survives well in similar environments to its own, but its weed potential has not been fully assessed.

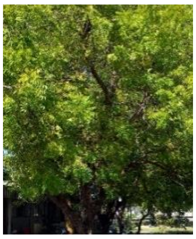
Neem leaves are dried in India and placed in cupboards to prevent insects eating the clothes, and also in tins where rice is stored. These flowers are also used in many Indian festivals like Ugadi. As an ayurvedic herb, neem is also used in baths.

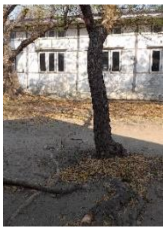
Neem is used in parts of mainland Southeast Asia, particularly in Cambodia, Laos, Thailand, Myanmar (where it is known as *tamar*) and Vietnam. Even lightly cooked, the flavour is quite bitter and the food is not enjoyed by all inhabitants of these nations, though it is believed to be good for one's health. Neem gum is a rich source of protein. In Myanmar, young neem leaves and flower buds are boiled with tamarind fruit to soften its bitterness and eaten as a vegetable. Pickled neem leaves are also eaten with tomato and fish paste sauce in Myanmar.

Products made from neem trees have been used in India for over two millennia for their medicinal properties. Neem products are believed by Siddha and Ayurvedic practitioners to be anthelmintic, antifungal, antidiabetic, antibacterial, antiviral, contraceptive, and sedative. It is considered a major component in Siddha



(a)





(b) (c)

Figure 1. Neem tree in front of the Department of Engineering Physics, Technological University (Mandalay)

medicine and Ayurvedic and Unani medicine and is particularly prescribed for skin diseases. Neem oil is also used for healthy hair, to improve liver function, detoxify the blood, and balance blood sugar levels. Neem leaves have also been used to treat skin diseases like eczema, psoriasis, etc.

Neem-based fertilizers have been effective against the pest southern armyworm. Neem cake is often sold as a fertilizer. The juice produced from this plant is a potent ingredient for a mixture of wall plaster.

Neem leaf or bark is considered an effective pitta pacifier because of its bitter taste. Neem leaves and flowers are very popular for their uses in India traditional festivals.

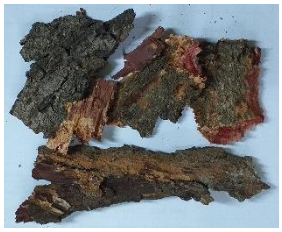
Previously, neem had been declared as the national tree of the former Hyderabad State. It is the state plant of Arunachal Pradesh [1,2,3].

The neem tree samples were collected in front of the Department of Engineering Physics (Figure 1), Technological University (Mandalay), Mandalay Region. They were prepared at Technological University (Mandalay) (Figures 2, 3 and 4) and measured at Materials Science Lab, Taungoo University (Figure 5),Bago Region. The data has been analysed at the Department of Engineering Physics, Technological University (Mandalay).

(a) (b)

(c)

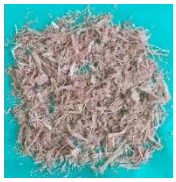
Figure 2. Sample preparation for neem leaves



(a) (b)

(c)

Figure 3.Sample preparation for neem barks



(a) (b)

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Figure 4. Sample preparation for neem roots

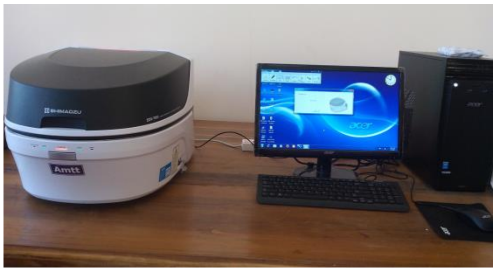

Figure 5. Shimadzu EDX-7000 Spectrometer at Materials Science Lab, Taungoo University

II. EXPERIMENTAL CONDITION

X-rays are a kind of electromagnetic wave discovered by German Physicist W.C. Roentgen (1845 – 1923) in 1893. When X-rays strike matter, some of them are absorbed by the matter and the rest pass through. The degree of absorption and penetration depends on the chemical elements that make up the matter as well as the thickness of the matter. Matter is composed of atoms, and when matter is struck by electrons or X-rays, X-rays of a wavelength (energy) that is specific to those atoms is generated from the matter. When a material is struck by electrons or X-rays, it generates new X-rays, called characteristic X-rays.

Fluorescent X-rays are characteristic X-rays produced as a result of a material being struck byX-rays only.

When a sample is irradiated with X-rays produced from an X-ray tube, the atoms in the sample generateunique X-rays that are emitted from the sample. Such X-rays are known as "fluorescent X-rays" and they have a unique wavelength and energy that is characteristic of each element that generates them. Consequently, q ualitative analysis can be performed by investigating the wavelengths of the X-rays. As the fluorescent X-ray intensity is a function of the concentration, quantitative analysis is also possible by measuring the amount ofX-rays at the wavelength specific to each element [4,5,6,7,8,9,10].

In the preparation of neem leaves (Figure 2), neem leaves were collected from neem tree in front of the Department of Engineering Physics, Technological University (Mandalay). Then, they were dried in shaded area for 3 weeks. After that they were ground to get fine powder using an agate mortar and pestle. In the preparation of neem barks (Figure 3), barks were also cut from that neem tree. Then, they were dried in shaded area for 3 weeks to get dried barks. After that they were powdered by the agate mortar and pestle. Roots sample preparation (Figure 4) was also the same as barks sample preparation. In that case, roots were taken from that same tree. And then, they were dried in shaded area for about 4 weeks to prepare fine powder. So, they were ready to grind using the agate mortar and pestle. All samples were prepared at TUM and analysed by using EDX-7000 spectrometer using fundamental parameter (FP balance) method located at the Materials Science Lab, Taungoo University, Bago Region.

III.RESULTS AND DISCUSSION

The largest element concentration in neem leaves (Table 1) is calcium. The second largest element concentration are potassium, sulphur and strontium. Iron, copper, titanium, manganese, bromine, zinc and rubidium are found as trace elements.

Table .1Elemental Concentration in Neem Leaves Sample

Sr No.	Element	Concentration (%)
1	Ca	1.314
2	K	0.842
3	S	0.114
4	Sr	0.011
5	Fe	0.008
6	Cu	0.002
7	Ti	0.002
8	Mn	0.001
9	Br	0.001
10	Zn	0.001
11	Rb	0.001

Table.2 Elemental Concentration in Neem Barks Sample

Sr No.	Element	Concentration (%)
1	Ca	0.911
2	K	0.094
3	S	0.068
4	Fe	0.024
5	Sr	0.006
6	Ti	0.004
7	Cu	0.002
8	Mn	0.002
9	Zn	0.001

Table .3 Elemental Concentration in Neem Roots Sample

Sr No.	Element	Concentration (%)
1	Ca	1.616
2	K	0.312
3	S	0.104
4	Fe	0.014
5	Sr	0.008
6	Ti	0.002
7	Mn	0.002
8	Cu	0.002
9	Zn	0.001

The same largest elemental concentration in neem barks (Table 2) is calcium. The second largest elemental concentrations are potassium, sulphur and iron. Strontium, titanium, copper, manganese and zinc are observed as trace elements.

The most prominent element is also calcium in neem roots (Table 3). Potassium, sulphur and iron are the second largest element concentration. Strontium, titanium, manganese, copper and zinc are trace elements.

The ingredients in neem tree are useful for human health. **Calcium** is found in bones and teeth. Ironically, calcium's most important role is in bodily functions, such as muscle contraction and protein regulation. **Potassium** helps regulate the heartbeat and is vital for electrical signaling in nerves. **Sulfur** is found in two amino acids that are important for giving proteins their shape.

The omission of **Strontium** caused an impairment of the calcification of the bones and teeth and a higher incidence of carious teeth. ^{90}Sr is one of the most abundant and potentially hazardous radioactive by products of nuclear fission and plants are more efficient than animals in the absorption of strontium.

Iron is a key element in the metabolism of almost all living organisms. It is also found in hemoglobin, which is the oxygen carrier in red blood cells. **Copper** is important as an electron donor in various biological reactions. Without enough copper, iron won't work properly in the body.

Titanium is so reactive that a titanium oxide skin forms spontaneously in contact with air, without the presence of water. **Manganese** is essential for certain enzymes, in particular those that protect mitochondria — the place where usable energy is generated inside cells — from dangerous oxidants.

Zinc is an essential trace element for all forms of life. Several proteins contain structures called "zinc fingers" help to regulate genes. Zinc deficiency has been known to lead to dwarfism in developing countries.

The additions of **Rubidium** or Cesium (Cs) to potassium-deficient diets prevent the lesions characteristic of potassium depletion in rats and supports near normal growth for short periods of time.

Bromine increases the growth rate of chicks and mice. It does not prevent the occurrence of goiter, and it is rapidly replaced by iodine when the latter is restored to the diet. More than one third of the iodine content in the thyroid was replaced by bromine.

IV. CONCLUSION

The neem tree has been investigated by using Energy Dispersive X-ray Fluorescence (EDXRF) detection technique. In this research, elements contained in neem tree are discussed and their corresponding benefits are presented. Neem tree supports not only for food but also for medicinal use. Further investigation on neem tree would complete the details of it.

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