

Investigation of Elemental Concentrations and Antioxidant Activity of Soursop Leaves

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Abstract: *The elemental concentrations of Soursop leaves (Du-Yinn-Aww-Zar) of dried powder sample were carried out by using the Energy Dispersive X-ray Fluorescence (EDXRF) detection method. The results showed that the most concentrated element in the Soursop leaves were K (0.548%) and Ca (0.401%). The other elements such as S, Fe, Cu, Mn and Zn were also observed in the Soursop leaves. The antioxidant activity of ethanolic extract from Soursop leaves were carried out by DPPH Radical Scavenging Assay method. The IC₅₀ value was found to be 14.85µg/mL for ethanol extract of Soursop leaves. The amounts of K and Ca level in blood were also discussed and the benefits of the Soursop leaves can effectively attack and destroy cancer cells and extensively use as traditional medicines for the treatment of uric acid, back pain, eczema and rheumatism, diabetes, boosts the immune system and prevents infections on the human body.*

Keywords: Soursop leaves, EDXRF, antioxidant, DPPH

1. INTRODUCTION

Most of medical plants were being used in treating diseases as traditional medicine. Soursop is one of the most commonly used medical plants. The Soursop plant is known as Soursop in English and Myanmar named (*Du-Yinn-Aww-Zar*). The name Soursop is due to sour and sweet flavor of its large fruit. This plant has many common names by country and it is also commonly known as Gunbanana or Graviola. Related species include sugar-apple and paw paw are also in the family. The Soursop is an evergreen plant that is mostly found in tropical, subtropical regions of the world and in the West Indies, North and South America, lowland of Africa, Pacific islands, and Southeast Asia from sea level to altitudes of around 1150 meters. This Soursop tree is an upright, with low branches and 5 to 10 meters tall. The flowers are yellowish in color and appear anywhere on the trunk or any branches. The fruit is prickly, oval or heart shaped, 10 to 15 centimeters in length with white fibrous juicy segments surrounding. The creamy, aromatic pulp is used in ice cream and juice. A fruit may contain as few as 5 or up to 100 seeds and can weigh more than 4 kilograms. The Soursop usually crop being 12 to 20 or 30 fruits per tree. The Soursop leaves are the most beneficial parts of the tree. The Soursop leaves tea was drunk daily and often mixed with other herbal decoctions. In this plant containing of Acetogenins compounds are often used in killing insects and pests which die by consuming these leaves even in small amounts. The fruits can occur early crop from January to April, with peak in March, April and May. The leaves are rich in annonaceous acetogenin, the most potent anticancer compound. In ancient time, it had been used as herbal remedies in treating diabetes, hypertension, fever, vomiting and against worm. It also has been used in treating headaches, cough, and asthma

as a sedative. The Soursop three with maturing fruits and ripe heart shaped fruit were showed in Figure 1. The yellowish flower and soursop leaves tea were illustrated in Figure 2.



Figure 1. Soursop tree with ripe heart shaped fruit



Figure 2. Soursop tree with maturing fruit, flower and Soursop leaves tea

2. MATERIAL AND METHOD

2.1. Sample Collection and Preparation

Fresh leaves of Soursop were collected from Daga city, near Patheingyi, Ayeyarwaddy Region, in Myanmar. The fresh leaves of Soursop were washed, air-dried at room temperature. The Soursop leaves were separated from the stalk then crushed into fine powder. After two weeks later, the dried leaves were crushed and ground into fine powder by using grinding machine, grounded with traditional agate motor and pestle. The sample preparation is very important for grinding machine process in order to get fine powder expressed in Figure 3 and Figure 4. The amount of 2g of powdered leaves were extracted using ethanol for 3 day. The extracted were then concentrated using rotary evaporator and dry block heater and kept for antioxidant activity.



Figure 3. (a) fresh leaves and (b) dried leaves

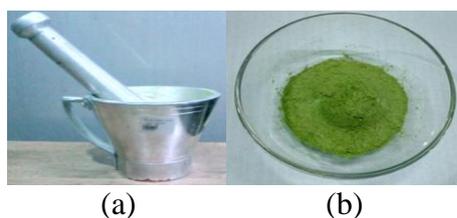


Figure 4. (a) Agate motor and pestle and (b) fine powder of Soursop leaves

2.2. Method of Energy Fluorescent X-ray

Measurements of elemental concentration were determined by using high precision of X-ray Fluorescence detection method. In the EDXRF analysis, the sample should be ensuring the homogeneous dense materials to obtain fine results in the X-rays emission spectroscopy. The elemental compositions in the Soursop leaves were observed on high performance fundamental parameter (FP) method over EDX-7000 system. The Fluorescent X-ray Spectroscopy is used for a wide range of applications to analyze samples in various forms, from solids to powders to liquids. X-ray is one kind of electromagnetic waves that is not easily absorbed by light elements but is easily absorbed by heavy elements. When the material is struck by electrons or X-rays, it generates new X-rays, called Fluorescent X-rays. An X-ray collides with an atom and an inner shell electron close to the nucleus of the atoms is knocked out, leaving a hole. An outer shell electron

drops into this hole and a high-energy orbit (outer shell) to a low-energy orbit (inner shell) radiates the energy difference as an electromagnetic wave, the fluorescent X-ray generated.

The fluorescent X-ray have a specific energy (wavelength) depending on the element struck, elements can be identified by measuring this energy (wavelength). Since the intensity of the fluorescent X-ray is proportional to the quantity of the relevant elements, the quantity of each element can be estimated by measuring this intensity. This method of analysis using fluorescent X-ray is called fluorescent analysis (XRF). The potential of this result were finding on Silicon Drift Detector (SDD) over Rhodium (Rh) target and sample observation with semiconductor camera. The fluorescent X-ray generated from the sample enter the semiconductor sensor at the same time.

Then, calculations for each element (each energy) are performed through electric signal processing and the fluorescent X-ray spectrum is obtained with multiple elements can be analyzed. The signals from the amplifier are successively sent to PHA and the PHA classifies information that shows which type of elements are represented. The elemental concentration detection method diagram is represented in Figure 5.

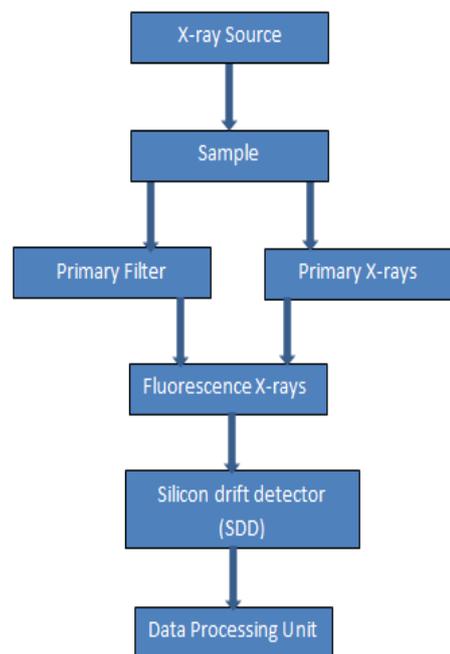


Figure 5. Schematic representation of measurement setup with EDXRF analysis

The Desk-top EDX-7000 Spectrometer is illustrated in Figure 6. The FP quantitative analysis compacts body with 100 V power supply with wide element range from Na to U. In the FP method all the sample information has to be reflected in the spectrum obtained from the spectrometer. The Specifications of



Figure 6. Photograph of Shimadzu EDX-7000 Spectrometer

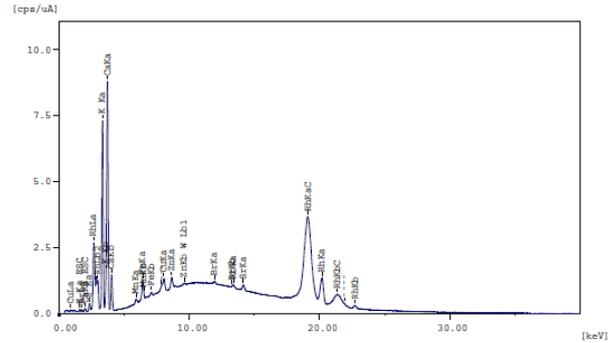


Figure 7. Measurement results of Soursop leaves on EDX-7000 Spectrometer

Table 1. Specification of shimadzu EDX-7000 spectrometer

Measurement principle	- X-ray fluorescence spectrometer
Measurement method	- Energy dispersive
Target sample	- Soursop leaves powder
Measuring range	- Na 11 to 92 U
X-ray tube	- Rhodium (Rh) target
Applied Voltage	- 4 kV to 50 kV
Current	- 1 μ A to 1000 μ A
Cooling method	- air cooling (with fan)
Irradiated area	- Automatic switching in 4 stages of 1, 3, 5 and 10mm diameter
Primary filters	-Automatic selection among 5 types of filter
Detector Type	- Silicon drift detector (SDD)
Measurement Atmosphere	- Air
Sample Chamber	- 12 - sample turret
Sample observations	- Semiconductor camera

Table 2. Elemental concentration of Soursop leaves

No	Element	Symbol	Concentration (%)
1	Potassium	K	0.548
2	Calcium	Ca	0.401
3	Sulphur	S	0.095
4	Iron	Fe	0.004
5	Copper	Cu	0.002
6	Manganese	Mn	0.001
7	zinc	Zn	0.001

3. RESULTS AND DISCUSSION

In the EDXRF measurement, the result showed that the largest concentrated element in the Soursop leaves were K (0.548%) and Ca (0.401%). The other elements such as S, Fe, Cu, Mn and Zn were also observed in the Soursop leaves. Table 2 and Figure 7 indicate that the Soursop contains the essential nutrients in our body. The element concentration in the Soursop was expressed in Figure 8.

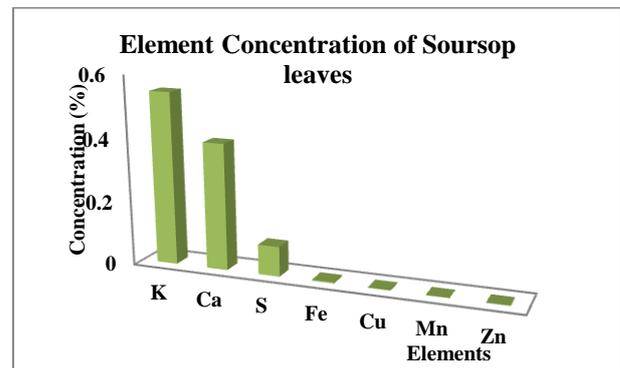


Figure 8. Photograph of Shimadzu EDX-7000

3.1. Antioxidant Activity of Crude Extracts of Soursop

The Antioxidant activity was carried on the ethanol extracted by DPPH assay. The IC_{50} is a standard of the effectiveness of a substance in inhibiting a specific biochemical function. IC_{50} value of a sample depends on the initial concentration of solution. If control absorption changes, the IC_{50} value of a sample will also change. IC_{50} values of ethanolic extract sample

and standard ascorbic acid were 14.85µg/mL and 9.47µg/mL.

Table 3. IC₅₀ value of Standard Ascorbic Acid and Soursop

Test Sample	IC ₅₀ Values (µg/mL)
Ascorbic Acid	9.47
Soursop	14.85

Table 3 and figure 9 show the bar graph of IC₅₀ value ethanol crude extract and standard ascorbic acid. The IC₅₀ of standard was 9 - 10µg and compare the crude with the standard. IC₅₀ value of Soursop is significant antioxidative effect. According to the comparison between IC₅₀ values of standard ascorbic acid and the extract sample, ethanol extract of Soursop possesses the rich antioxidant property.

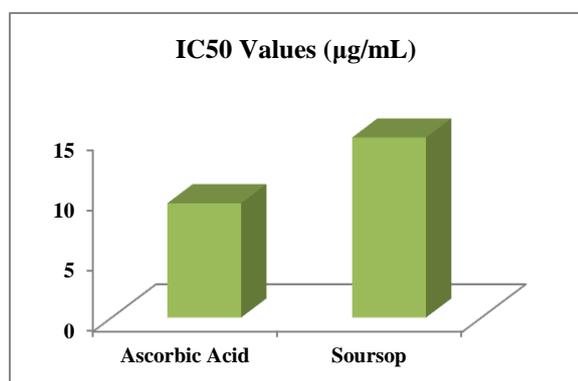


Figure 9. IC₅₀ values of Ascorbic Acid and Soursop

3.2. Health Benefits and Characterizations of Soursop leaves

3.2.1. Potassium

The most concentrated element in Soursop leaves was *Potassium*. It is one of the most important minerals in the body. It helps regulate fluid balance, muscle contractions and nerve signals. A high potassium diet may help reduce blood pressure and water retention, protect against stroke and prevent osteoporosis and kidney stones. Adults should consume about 3500 mg of Potassium per day, according to the UK's National Health Service. A low potassium level can make muscles feel weak, cramp, twitch, or even become paralysed, and abnormal heart may develop.

3.2.2. Calcium

Calcium is the most abundant mineral and vital for bone health. Around 99% Calcium in the human body is found in the bone and teeth. Calcium continues strengthening the bones of humans until they reach the

age of 20 - 25 when bone density is highest. After that age, bone density declines, but calcium continues to help maintain bones and slowly down bone density loss. A certain amount of calcium to build and maintains strong bones and healthy communication between the brain and other parts of the body. Calcium is very essential not only muscle construction, building strong bones and teeth but also blood clotting, nerve impulse, transmission, regulating heart beat and fluid balance with the cells.

3.2.3. Sulphur

Sulphur is present in all living tissues. It is the third most abundant mineral in the human body. Sulphur has antibacterial, antifungal that effect against the bacteria that cause acne. This is believed to help treat skin conditions.

3.2.4. Iron

Iron is an important component of haemoglobin, the substance in red blood cells that carries oxygen from lungs to transport it throughout human body. Haemoglobin represents about two-thirds of the body's

3.2.5. Copper

An essential nutrient for the body together with iron, it enables the body to form red blood cells. It helps maintain healthy bones, blood vessels, nerves, and immune function.

3.2.6. Manganese

Manganese is essential plant nutrients. Magnesium is one of the secondary plant nutrients along with sulphur and calcium. It is not only necessary for humans to survive but also effects occur mainly in the respiratory tract and in the brains.

3.2.7. Zinc

Zinc is found in cells throughout the body. It helps the immune system fight off invading bacteria and viruses. Zinc plays an important role in hair tissue growth and repair.

3.3. Medicinal Uses of Du-Yinn-Aww-Zar

The Soursop leaves have been used in many traditional medicinal systems. It has many medicinal values such as to cure fever, headaches, cough, asthma and hypertension. Soursop leaves can inhibit cancer cells and cure cancer more quickly and effectively than chemotherapy which results in several side effects besides being expensive. Research has proved that Soursop has an active ingredient that is 10000 times stronger than chemotherapy in fighting cancer cells.

Thus Soursop leaves can treat different types of cancers including prostate, lung and breast cancers.

3.3.1. Treatment of Cancer

For treatment, boil 10 Soursop leaves in 3 cups of water until only one cup of water remains, strain and cool it and drink this concoction every morning for 3-4 weeks to determine improvement in the condition.

3.3.2. Treatment of Uric Acid

Eating Soursop leaves can greatly help entreating gout. In fact, many alternative medicines use Soursop leaves for treatment of gout. For this purpose, take 6 to 10 Soursop leaves which are old but still green and wash them clean, Boil the leaves in 2 cups of water and simmer until one cup of water remains. This concoction should be taken twice a day i.e., morning and evening for maximum benefits.

3.3.3. Treatment of Diabetes

The limit of normal sugar level ranges from 70 mg to 120 mg. The nutrients in Soursop leave in the normal range. Besides, the extracts of Soursop leaves can be used as one of the natural diabetes remedies. All make the Soursop leaves beneficial for diabetics.

3.3.4. Boosts the Immune System and Prevents infections:

Boil 4/5 Soursop leaves in 4 cups of water until one cup of water remains and drink this concoction regularly once in a day for beneficial results.

4. CONCLUSIONS

In this research study, the observation of Soursop leaves in the EDXRF analysis, the result showed that the largest concentrated element were *K* (0.548%) and *Ca* (0.401%). *IC*₅₀ values of ethanolic extract sample and standard ascorbic acid were 14.85µg/mL and 9.47µg/mL. According to the comparison between *IC*₅₀ values of standard ascorbic acid and the extract sample, ethanolic extract of Soursop possesses the rich antioxidant property. It can be concluded that Soursop (*Du-Yinn-Aww-zar*) should be taken daily to get minerals which are beneficial for human health and the leaves have excellent medicinal properties.

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