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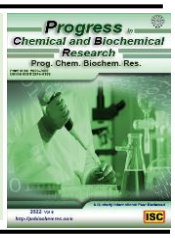

Original Research Article

Comparative Energy Dispersive X- Ray Fluorescence Analysis of *Mangifera Indica L.* Leaves In the Locality of Kachchh and Saurashtra

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ABSTRACT

The aim of the present study was to determine the comparative investigation of chemical composition in the leaves of *Mangifera indica L.* in the region of Kachchh and Saurashtra. *Mangifera Indica L.* belongs to the anacardiaceae family. The leaves of *Mangifera Indica L.* were subjected to energy dispersive X-ray fluorescence (EDXRF) and analysed for different mineral compositions. As we know, XRF is one of the most sensitive, accurate, consistent, and non-destructive methods for analysing major and trace elements by using a single pressed pellet. During the analysis, it was found that in kachchh and Saurashtra region, *Mangifera Indica L.* leaves contain silicon, calcium, potassium, chlorine, sulphur, magnesium, aluminium, and iron were noted in higher amounts compared with that of other elements like strontium, manganese, titanium, bromine, zinc, barium, rubidium, nickel, silver, lead, molybdenum, etc. whereas the elements which were not detected in the leaves of *Mangifera Indica L.* are sodium, vanadium, uranium, mercury, silver, gold, etc. In comparison of Kachchh and Saurashtra region of *Mangifera Indica L.* leaves calcium, silicon, potassium, aluminium, phosphorus, and iron were high in the region of Saurashtra rather than the Kachchh leaves and other elements are presented in trace amount.

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GRAPHICAL ABSTRACT

Introduction

X-Ray fluorescence (XRF)[1][2] is an analytical method which is firstly use for the lead detection (Pb)[3] in paint in the 1970s for the abatement and exposure studies [4]. It has been since use for the environmental analysis like alloys [5], geological materials [6], glasses, and sediments [7] with very minimal sample preparation and treatment. During several times, XRF has been accepted by the environmental research community as a viable analytical tool through the efficiency of excitation of the radioisotope source [8] in conjunction with extremely sensitive detectors [9] and other electronics. Therefore, it offers multi-element analytical capability [10], economy, high speed, and simplified operation where its advantages [11] and limitations [12] are well-understood.

Mangifera Indica L. (anacardiaceae) [13] is a large leafy tree valued mainly for its green and ripe fruit [14]. About 500 mango varieties have been reported in India [15]. It can grow up to 1530 meters high. The tree grows best in well-drained sandy loam; it does not grow well in heavy wet soil. The optimal soil pH should be between 5.2 and 7.5 [16].

Figure 1. *Mangifera Indica L.* plant photograph

Figure 2. Powder sample of *Mangifera Indica L.*, Kachchh Region

Figure 3. Powder sample of *Mangifera Indica L.*, Saurashtra Region

Mango fruit has a high nutritional value and health benefits [17] due to important components [18]. Mango fruit contains phytochemicals [19] like polyphenol, pigments, phenolic, and volatile constituents [20]. They also contain carbohydrates and cellulose [21]. Mango fruit also give anti-oxidant activity [22].

In recent years, traditional medicines have been extracted from medicinal plants [23]. The use of mango as a traditional medicine to treat diabetes [24], inflammation [25], bacteria [26], fungi, and gastric protection [27] has been further studied.

Botanical classification [28]

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Superdivision: Spermatophyta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Subclass: Rosidae
- Order: Sapindales
- Family: Anacardiaceae
- Genus: Mangifera
- Species: M. indica

Common names of different regions [28]

The common names of *Mangifera Indica L.* are as follow:

- Arabic : Mabaz
- Bengali : Am (Um)
- Chinese: Mi wang
- Danish: Mango, Mangofrugt, and Mangotrae
- Dutch: Manga, Mangga, Manja, and Mangoestanboom
- English: Mango
- French: Mangue and Manguier
- German: Indischer Mangobaum and Mango
- Greek: Magko and Mangko
- Gujarat: Ambo
- Hindi: Am, Ambi, and Amia
- Japanese: Anchaa, Mangoo, and Mangou
- Kachchh: Ambo

Experimental

Materials and methods

Sample preparation

Leaves of *Mangifera Indica L.* were collected in Kachchh and Saurashtra Regions of Gujarat in November December 2020. The leaves were sun dried to evaporate the water content from them. Then, it was grounded in mixture and with the help of pellet maker. Pellets from leaf samples were used for further elemental analysis in on-instrument energy dispersive X-ray fluorescence.

Instrumental parameters

Rigaku elemental analyzer are benchtop X-ray fluorescence (XRF) with element range Na to U with Pd anode X-ray tube with a high

performance SDD detector by using NEX CG software.

Figure 6. Pellet of *Mangifera Indica L.*, Kachchh Region

Figure 7. Pellet of *Mangifera Indica L.*, Saurashtra Region

Results and Discussion

Chemistry

The *Mangifera Indica L*. Leaves growing in the region between Northwest like India, Myanmar, and Bangladesh. *Mangifera Indica L*. was collected from Kachchh and Saurashtra districts and subjected to the X-ray fluorescence instrument for mineral analysis for the present study. Various and large amounts of mineral ions were found during the analysis.

The main constituent calcium (Ca) is a nutrient that all living organisms need, including humans. It is the most abundant mineral in the body and is critical to bone health, found in the leaves of *M. Indica L.* in the Kachchh and Saurashtra Regions was 2.56% and 3.21%, respectively. Potassium (K) content, considered an important component for the body, was found in Kachchh and Saurashtra to be 1.07% and 1.20%, respectively. Silicon (Si), which is not only a good soil binder, but is also used for many industrial purposes, was also found in larger amounts in the leaves of *M. Indica L*. for Kachchh and Saurashtra at 3.13% and 2.14%, respectively found.

Table 1. The XRF analysis of *Mangifera Indica L.*, Kachchh Region

Sr. No.	Element	% Mass
1	Si	3.13
2	Ca	2.56
3	K	1.07
4	Cl	0.419
5	S	0.370
6	Mg	0.328
7	Al	0.308
8	P	0.203
9	Fe	0.0641
10	Sr	0.0233
11	Mn	0.0063
12	Ti	0.0042
13	Br	0.0031
14	Zn	0.0029
15	Cu	0.0018
16	Zr	0.0016
17	Ba	0.0008

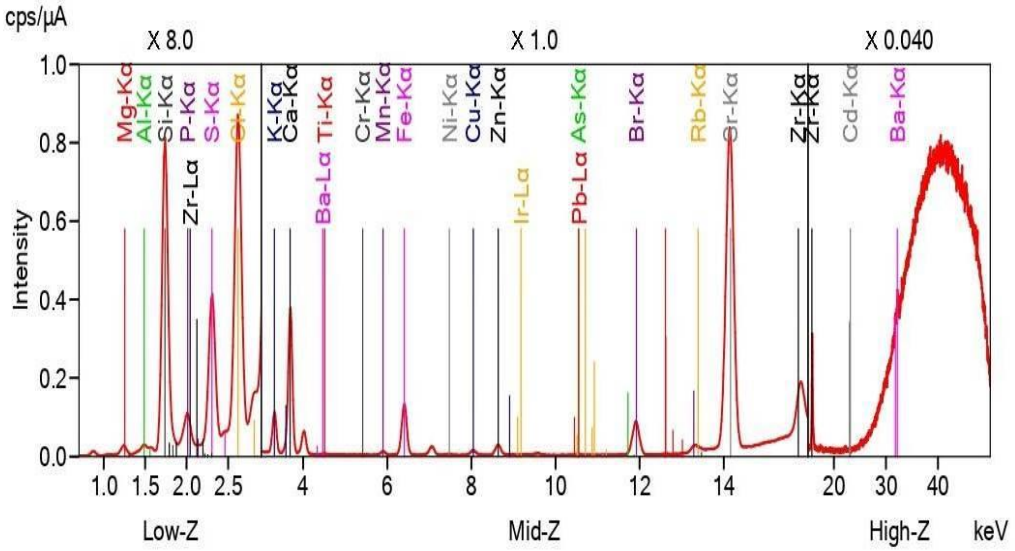

Figure 4. The XRF graph for mineral ion in the leaves of *Mangifera Indica L*, Kachchh Region

Table 2. The XRF analysis of *Mangifera Indica L.*, Saurashtra Region

Sr. No.	Element	% Mass
1	Si	2.14
2	Ca	3.21
3	K	1.20
4	Cl	0.249
5	S	0.266
6	Mg	0.238
7	Al	0.312
8	P	0.228
9	Fe	0.112
10	Sr	0.0162
11	Mn	0.0058
12	Ti	0.0089
13	Br	0.0008
14	Zn	0.0029
15	Cu	0.0017
16	Zr	0.0012
17	Cr	0.0018
18	Rb	0.0007
19	Ni	0.0006
20	Ag	0.0001
21	Pb	0.0001
22	Mo	0.0001

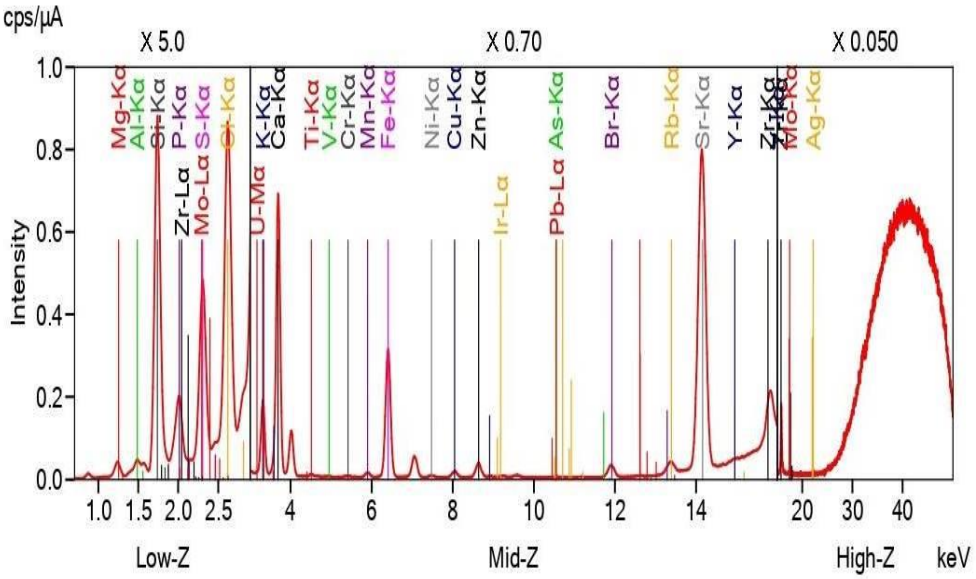

Figure 5. The XRF Graph for mineral ion in the leaves of *Mangifera Indica L.*, Saurashtra Region

The major component found in the leaves of M. Indica L. from Kachchh area is chlorine (0.419%), sulphur (0.370%), magnesium (0.328%), aluminium (0.308%), and phosphorus (0.203%) and for the Saurashtra area, chlorine (0.249%), sulphur (0.266%), magnesium (0.238%), aluminium (0.312%) , phosphorus (0.228%), and Fe (0.112%) were noted.

Important findings from the leaves of *Mangifera Indica L.* were the presence of strontium (Sr), manganese (Mn), titanium (Ti), bromine (Br), zinc (Zn), copper (Cu), zirconium (Zr), barium (Ba), chromium (Cr), rubidium (Rb), nickel (Ni), silver (Ag), lead (Pb), and molybdenum (Mo) were found in trace amounts.

The elements which were undetected were Y, As, U, Na, Ru, Rh, Cd, Sn, Sb, Au, La, Ce, Pr, Nd, W, etc.

Conclusion

The ED XRF method is a powerful technique for analysing various anions and cations found in the leaves of *Mangifera Indica L.* in the regions of Kachchh and Saurashtra in Gujarat, India. The components with higher values in Saurashtra are calcium, silicon, potassium, aluminium, phosphorus, and iron compared with the Kachchh Region and other elements like chlorine, strontium, manganese, titanium, bromine, zinc, copper, zirconium, barium, chromium, rubidium, nickel, silver, lead, and molybdenum were found in traces.

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Supporting Information

Mangifera Indica L. was found in Kachchh and Saurashtra Region of Gujarat. The XRF analysis data and experimental method are available in the supplementary file.

Compliance with Standards

This article does not contain any studies involving human participants performed by any authors and does not contain any studies involving animals performed by any of the author.

Conflict of Interest

The authors report no conflicts of interest

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