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XRF analysis of *Carica papaya* leaves of semi arid region of Kachchh

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ABSTRACT

The objective of the present investigation was to study the chemical composition of leaves of *Carica papaya* belonging to family *Caricaceae* growing in semi-arid region of Kachchh district, Gujarat, India. The leaves of *C. papaya* were subjected to Energy Dispersive X-ray Fluorescence (EDXRF) and were analyzed for different mineral composition. As the X-ray Fluorescence is one of the most reliable and accurate, as well as it is also a consistent and non-destructive method for analysis of major and trace elements using a single pressed pellet. During the study it was found that Oxygen, Calcium, Magnessium, Potassium were noted in higher amounts, compared to that of other elements like Silicon, Sulphur, Phosphorus, Chloride, Strontium, Stanous, Aluminium, Cromium and Mangenese, whereas the elements which were not detected in leaves of *C. papaya* are Vanadium, Titanium, Cobalt and Tantalum.

***Keywords*:** Energy Dispersive X-ray Fluorescence (EDXRF) analysis; *Carica Papiya* leaves; Semi arid region; Element

1. INTRODUCTION

X-ray fluorescence spectrometry has been a very fascinating analytical tool, because it is an essentially simultaneous multi element, precise and nondestructive analytical method. However, this spectrometry is similar in empirical conversion procedure (from line intensities to composition) to other instrumental methods of analysis.

Carica papaya (family: *Caricaceae*) is a large tree-like plant with a single stem growing from 5 to 10 m (16 to 33 ft) tall with spirally arranged leaves confined to the top of the trunk. The lower trunk is conspicuously scarred where leaves and fruit were borne. The leaves are large, 50 to 70 cm diameter, deeply palmately lobed with 7 lobes. Papaya fruits had extensively studied and reported for their anti fungal (Giordani et al., 2009).

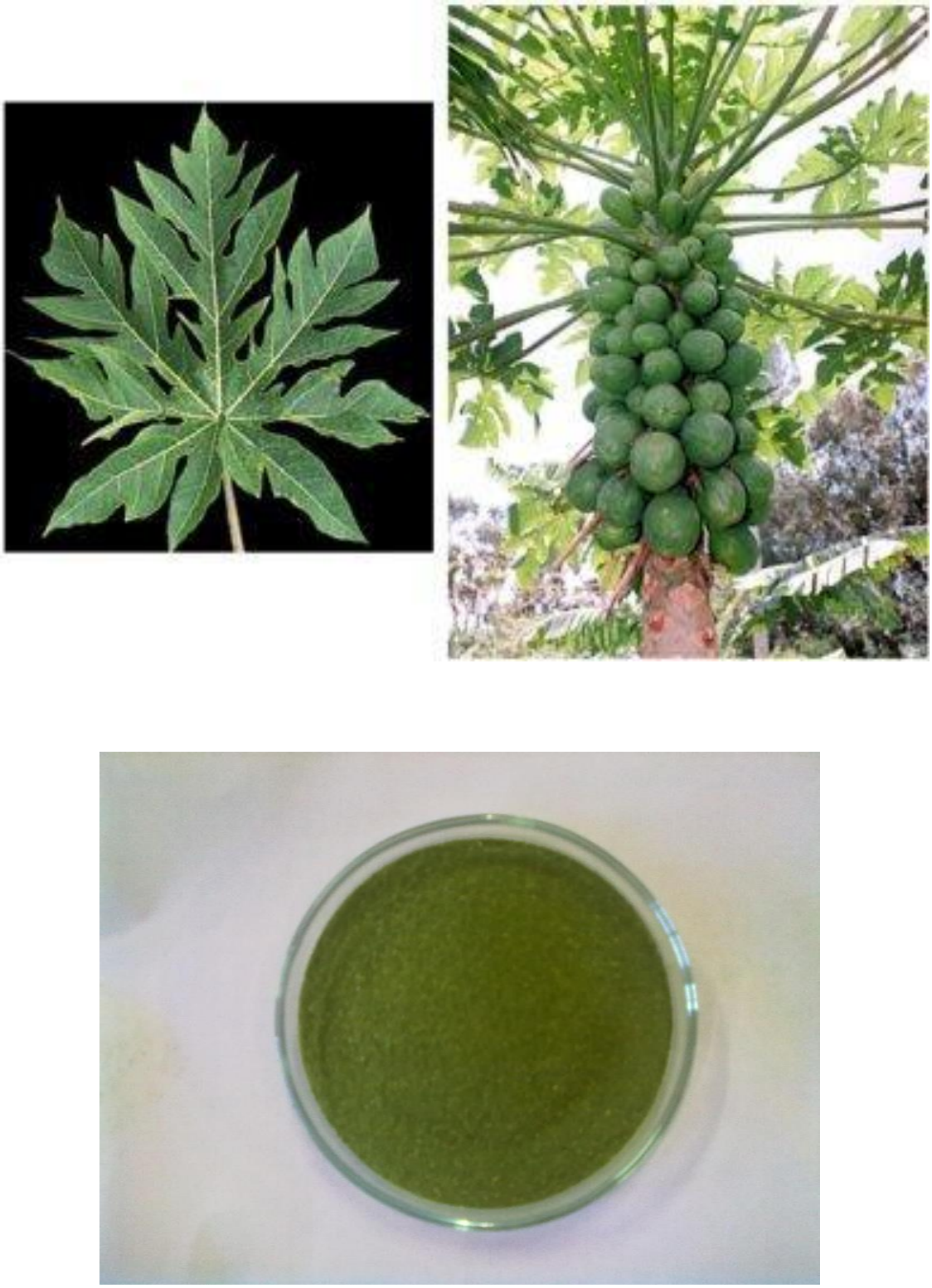

Photo 1. Plates of C. papaya growing in semi-arid region of Kachchh.

The fruit of some species of Vasconcella may be used as a food source, particularly in some regions of South and central America, but such usage is relatively limited. Recently, similar kind of study on the mineral composition of leaves of *C. papaya* was analyzed by traditional and normal methodology for mineral analysis (Suhas J. Vyas, 2014). Leaves of ardusi were analyzed by spectrophotometer (Kamlesh Khokhani, 2012).

One of the biggest effects that viral infections have on papaya is the taste. Right now, the virus is uncontrollable (Gonsalves, D., et al.,2010). The difference between the ringspot and the mosaic viruses is the ripe fruit in the ringspot has mottling of colors and mosaic does not (Hine, B.R. et. al., 1965). The fruit ends up being soft and having an off flavor because the fungus grows into the fruit (Mossler, M.A. & Crane, J. 2002). Two kinds of papayas are commonly grown.

1. 1. Botanical review

- Kingdom : *Plantae* – Plant
- Subkingdom : *Tracheobionta* – Vascular plants
- Superdivision : *Spermatophyta* – Seed plants
- Division : *Magnoliophyta* – Flowering plants
- Class : *Magnoliopsida* – Dicotyledons
- Subclass : *Dilleniidae*
- Order : *Violales*
- Family : *Caricaceae* – Papaya family
- Genus : *Carica* L. – papaya
- Species : *Carica papaya* L. – papaya

1. 2. Names in different languages

- English : Papaya;
- Hindi : Pappaya, Pappita;
- Malayalam : Pappaya, Karumoos, Kappalam, Pappali, Karmati;
- Bengali : Pappaiya, Papeya;
- Gujarati : Papayi, Papai;
- Kannad : Parangi, Parangimara;
- Sanskrit : Erandakarkati, Brehmeranda;
- Marathi : Popai, Papaya;
- Tamil : Paalai, Pappali;
- Tellegu : Bappayi, Boppayi.

2. EXPERIMENTAL

2. 1. Sample Preparation

Leaves of *C. papaya* were collected from different habitats of Kachchh region of Gujarat during December, 2013. Leaves were sun dried to evaporate water content from it, after then it was grinded in mixture and with the help of pallete maker, pallets of leaves sample were prepared and were used for further elemental analysis in X-ray Fluorescence instrument.

2. 2. Instrumental Parameter

Bench-top Energy Dispersive X-ray Fluorescence (EDXRF) of make Rigaku elemental analyzer with element range Na to U having Pd anode X ray Tube with high performance SDD detector with the use of NEX CG software.

3. RESULT AND DISCUSSION

Table 1. Composition by X-ray Fluorescence.

Sr. No	Element	% Mass
1	Mg	3.37
2	Al	0.166
3	Si	0.866
4	P	0.528
5	S	0.733
6	Cl	0.805
7	K	1.49
8	Ca	4.77
9	Ti	ND
10	V	ND
11	Cr	0.0129
12	Mn	0.0031
13	Fe	0.0950
14	Co	ND
15	Cu	0.0017
16	Zn	0.0039
17	Se	0.0005
18	Br	0.0117
19	Rb	0.0015
20	Sr	0.107
21	Sn	0.0046
22	Ta	ND
23	O	87.0

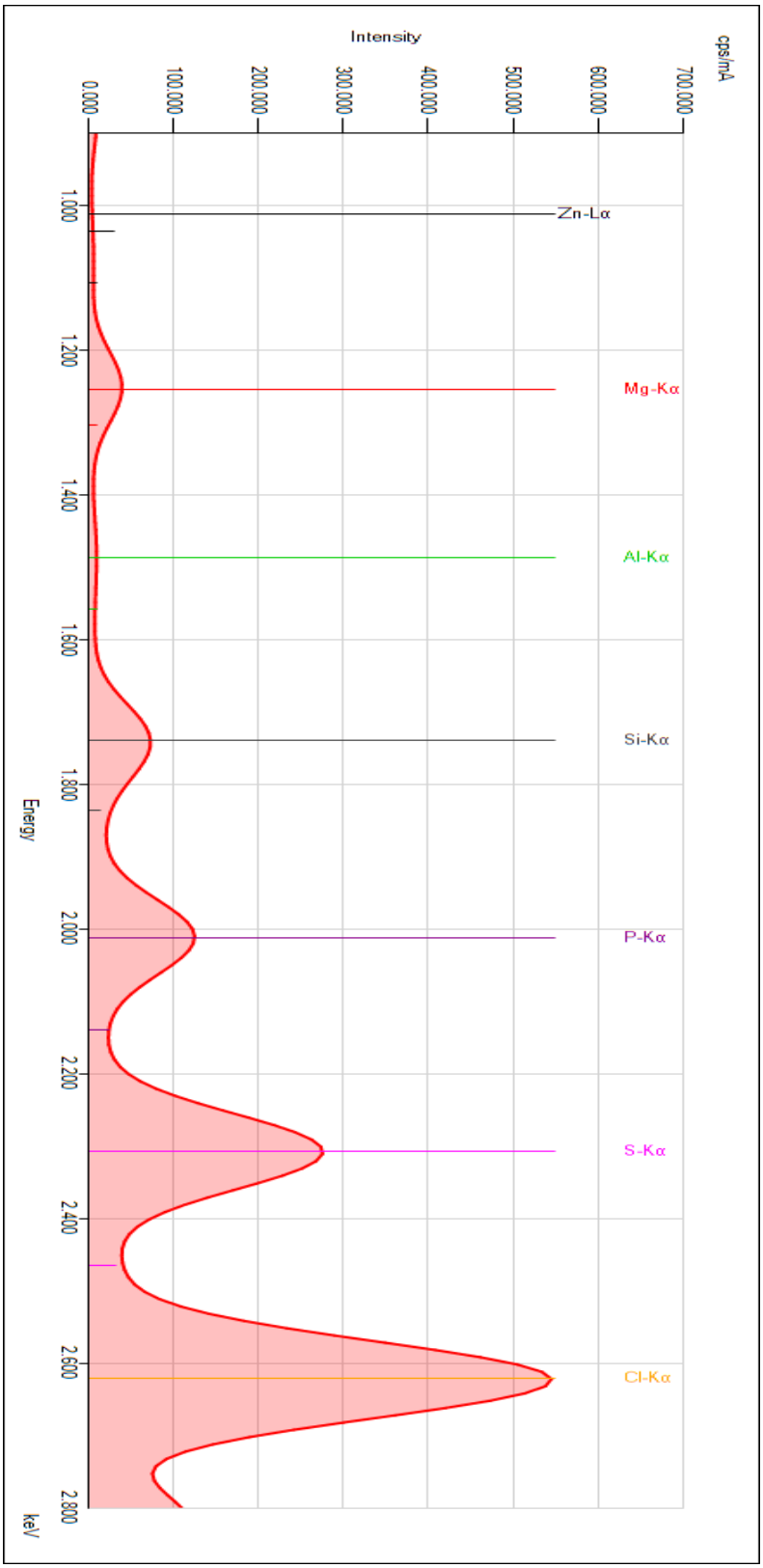

Figure 1(a). Graph of XRF for mineral ion in the leaves of C. papaya.

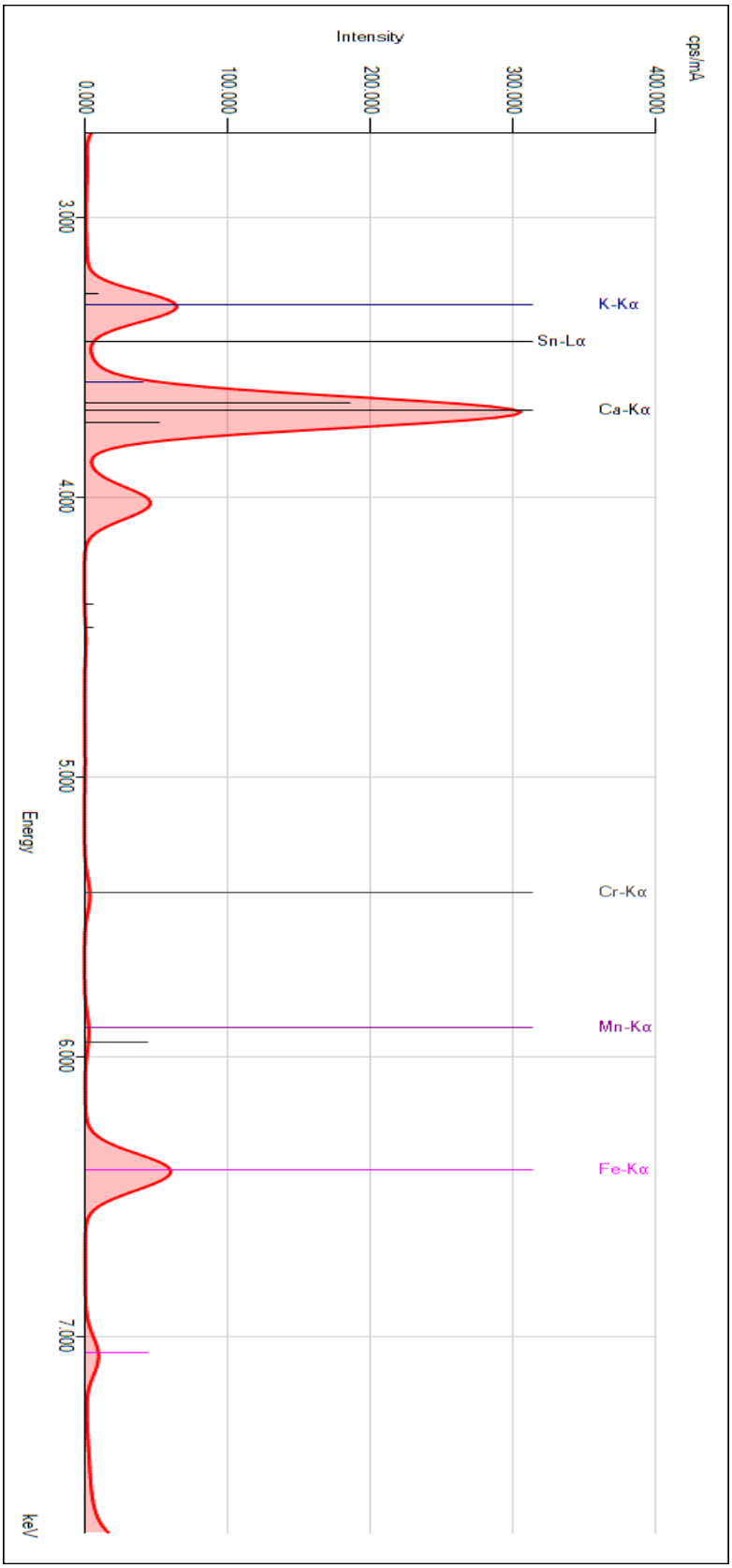

Figure 1(b). Graph of XRF for mineral ion in the leaves of C. papaya.

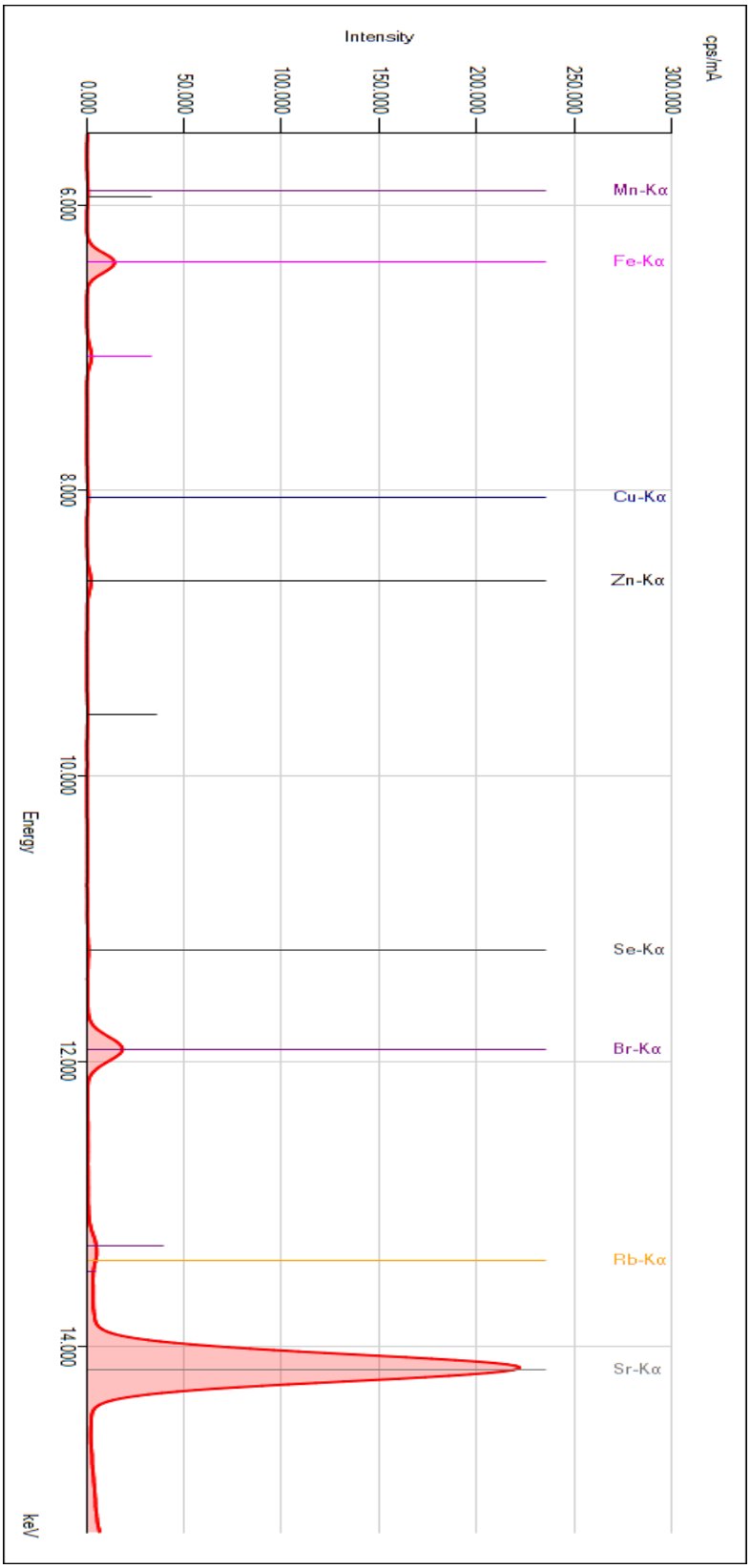

Figure 1(c). Graph of XRF for mineral ion in the leaves of C. papaya.

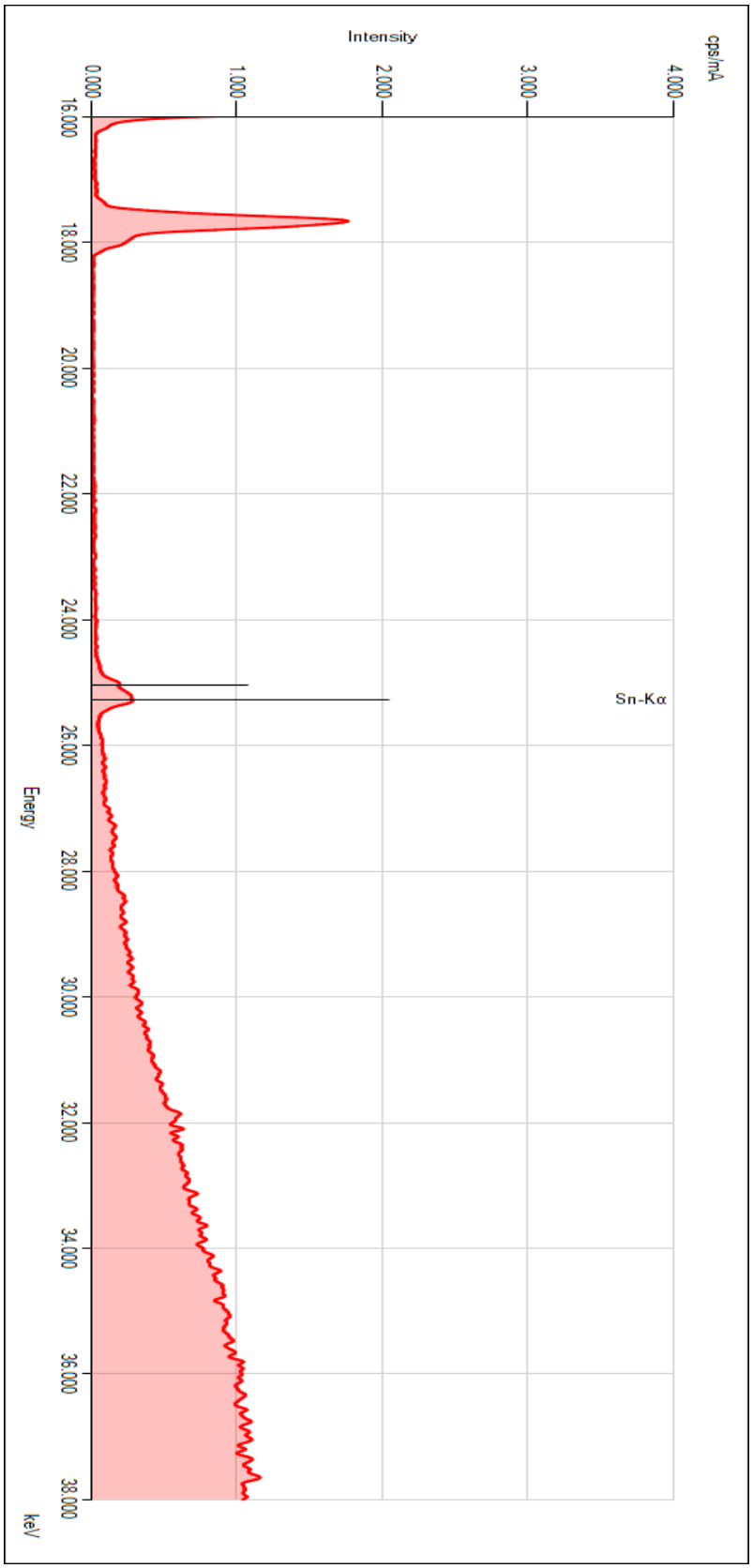

Figure 1(d). Graph of XRF for mineral ion in the leaves of C. papaya.

Leaves of *C. papaya* growing in semi-arid region of Kachchh district were collected and were subjected to X-ray Flourescence instrument for mineral analysis for the present investigation. Various mineral ions like were found during the analysis.

The major component in the leaves of *C. papaya* constituted Oxygen (O) (percent wise) which was found to be 87.0 %, whereas Calcium (Ca) and Magnessium (Mg) were noted to be 4.77 % and 3.37 %, respectively. Potassium (K) content which is considered to be important constituent for the body was found to be 1.49 % in the leaves of *C. papaya*. Silicon (Si) which is not only a good soil binder but also is useful for many industrial purposes, it was also found in the leaves of *C. papaya* of 0.866 %. Mineral ion Chloride (Cl), in the form of Chlorine is one of the major and important constituents in the humans and animal body. Chloride was recorded in the similar range of Si, it was 0.805 %.

Major content of Phosphorus (P) is found in the bones and teeth, in leaves of *C. papaya* it was found to be 0.528 %. Sulphur concentration in leaves of *C. papaya* was marginally higher (0.733 %) to that of sulphur. Aluminium (Al) and Strontium (Sr) were found to be 0.166 % and 0.107 %, respectively. Iron (Fe) concentration was noted to be 0.0950 %. Chromium (Cr), 0.0129 % and Bromine (Br), 0.0117 % were found to be in similar range. Important findings from the leaves of the *C. papaya* was to note the presence of Tin (Sn) of 0.0046 %. Heavy metals like Zinc (Zn) and Manganese (Mn) were found to be 0.0039 % and 0.0031 %. Copper (Cu) in the leaves of *C. papaya* was found to be 0.0017 %, whereas Rubidium (Rb) was noted to be 0.0015 %.

The elements which were undetected were Titanium (Ti), Vanadium (V), Cobalt (Co) and Tantalum (Ta) in the leaves of *C. papaya* growing in semi-arid region of Kachchh district in Gujarat.

4. CONCLUSIONS

The XRF method is a powerful tool for the analysis of different cations and anions. In the leaves of *C. papaya* found in this semi-arid region of Kachchh in Gujarat, India, the elements which had higher values in terms of percentage are Oxygen, Calcium, Magnessium, Potassium, Phosphorus and Chloride. The elements which had lower values in comparison to these elements are Silicon, Sulphur, Strontium, Stanous, Aluminium, Cromium and Mangenese. Based on this study it can be concluded that the leaves of *C. papaya* growing in the semi-arid region has a good quantity of oxygen and Calcium. Traditionally, the leaves of *C. papaya* are used by local population for various medicinal purposes like curing dengue and other diseases.

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