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Chemical Composition and Quantitative Elemental Investigation of Bitter Melon

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ABSTRACT

Researchers have found many interesting properties of bitter melon and therefore attracted many others on its studies. Bitter melon belongs to cucurbitacea family and momordica genus. Bitter melon is used for human consumption all over the world in different forms such as a vegetable and /or medicine. Some of the research work has been done on the fruits, its seeds and leaves but the other parts such as tissues has not been studied. The present study is an extensive investigation of the quantitative elements for Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Pb, Zn, K, N, and P of the fruit- skin, fruit-flesh, fruit-seed, tissue skin, leaf and root of bitter melon for the first time using flame atomic absorption spectrometry. The results show a quite good variation of the concentration of the elements in different part of the fruit and the tissue.

***Keywords*:** Bitter melon; Karaila; *Momordica charantia*; AAS; Nutrients; Elements

1. INTRODUCTION

Bitter melon known as *Momordica charantia* (Binomial name), bitter gourd, bitter squash, Karaila. It has also different names in different countries. It belongs to cucurbitaceae family and momordica genus.

Fig. 1. Unripped fruit of bitter melon.

Fig. 2. Ripped fruit of better melon.

(A)

(B)

Fig. 3(A,B). Fruit, stem and leaves of bitter melon.

Wahioedi et al [1] have studied the effect of orally given an amount of 200 mg/100 body weight per day for 3 months of the juice of bitter melon to the rats and no bad effect was found on any part of their bodies. It is reported in literature that fruits and leaves of bitter melon are in use for a traditional way from a long time as a vegetable and medicine. A few nutrients are reported in different parts of bitter melon by Trivedi et al [2].

The leaves contain acidic resins, momordicine, aminobutyric acid, vitamin B, vitamin C, calcium, carotene, potassium, phosphorus and iron. The root contains silicon, calcium, phosphorus, stronsium, zinc, sodium and iron. The fruit contains peptic acid, steorites, glucosides, saponins. The seed contains stearic acid, oelic acid, linoleic, albumin, globulin, niacin, pantotheric acid, vitamin B carotene, amino butyric acid. The fruit consists of glycosides, saponins, alkaloids, resins, charantine, chorine, cryptoxalanthin, cucurbitins, cucurbitacines, cucurbitanes, cycloartenols, glacturonic acid, gentisin acid, goyaglycosides, goyasapponine but the relative amounts are not mentioned.

The fruit is known as a source of antibilous, laxative, stimulant and stomacie. It purifies blood and therefore helps to cure liver and spleen diseases. The leaves are also in use to prepare tea which is found very useful in case of diabetes, malaria, sores, wounds, worms and parasites. The glycoproteins extracted from seeds are in use to terminate early abortion as reported by Chan et al [3].

The various constituents of crude bitter melon extract have shown anti- cancer activity and cytotoxic activity against leukemic cell [4]. Alpha and beta- momorcharins have been reported to exhibit HIV virus [5].

The antibacterial activity of bitter melon to treat the bacterial infection [6]. The bio-active compounds of bitter melon in relation to their physiological function such as polyphenolics, antioxidant and antimutagenicity have been studied [7]. The fruits have green and white skin and they differ very much in many properties. The green fruit is bitter than the white fruit. The phytochemistry of bitter melon leaves revealed the presence of flavonoids and tannis [8].

Trace elements and major minerals evaluation in mg/kg such as Fe (8.125), Zn (354.8), Mn (37.0), Cr (162.0), Cu (21.0), Cd (54.40) and Pb (48.0) were reported by Ayoola et al [9]. The study indicated that momordicilin is a potential exhibitor of glycogene synthase kinase 3 and can be used as a major anti-diabetic compound from bitter melon [10]. Antioxidant and chemoprotective properties of bitter melon fruit extract has been examined by Ray [11]. Ray has also established that bitter melon extract decreases breast cancer growth [12]. A review of the related works has been reported by Sahu et al. [13] of bitter melon.

2. EXPERIMENTAL

The present investigation has been taken to make a thorough study of bitter melon and therefore the fruit containing skin, flesh, seeds and the leaves, skin from the stem and roots were collected from the same plant from an agricultural farm. All the parts were separated and properly washed with deionized water.

A fine layer of fruit's skin was peeled off carefully with plastic knife and washed again with the deionized water and the flesh was also washed again with deionized water. 10.0 g of each sample was kept in the separate crucibles in an oven at a temperature of 50 °C for 30 minutes. It was noticed that the seeds and leaves were dried completely.

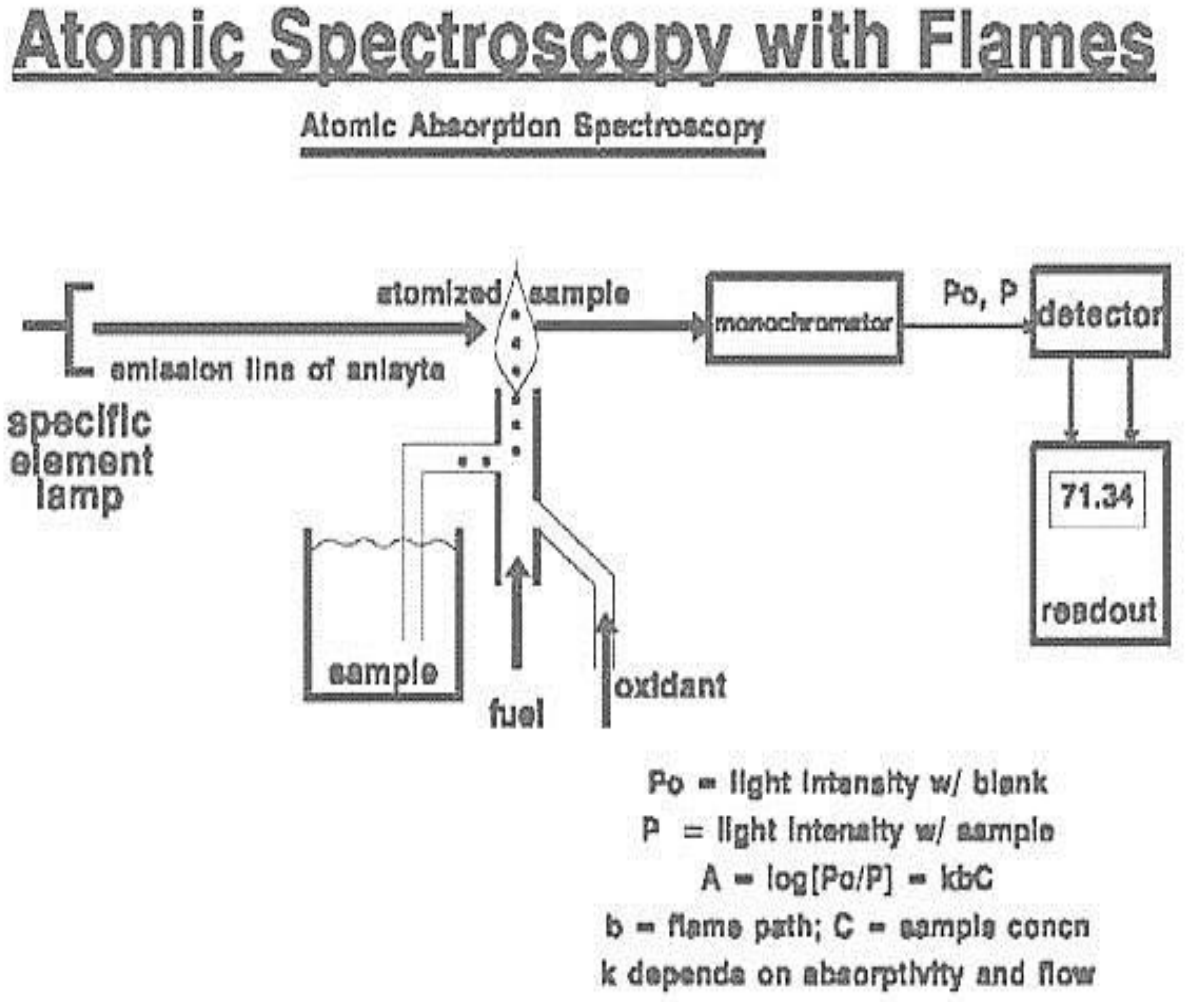

Fig. 4. Experimental set up of a flame atomic absorption spectrometer to record data.

Table 1. Showing Percentage of Some Elements in Bitter Melon.

Samples Description	Parameters		
	K %	N %	P %
Fruit-Skin	8.70	3.40	0.50
Fruit-Flesh	5.60	1.50	0.30
Fruit-Seed	1.80	1.10	0.70

Table 2. Shows the spectral data of elements for different parts of Bitter Melon.

Samples Description	Parameters									
	Ca ppm	**Cd ppm**	**Co ppm**	**Cr ppm**	**Cu ppm**	**Fe ppm**	**Mg ppm**	**Mn ppm**	**Pb ppm**	**Zn ppm**
Fruit-Skin	1806	nd	4.83	nd	2.01	58.08	2082	nd	nd	32.05
Fruit-Flesh	1294	nd	9.16	nd	nd	96.07	1294	nd	nd	51.13
Fruit-Seed	1728	nd	3.86	nd	6.38	65.21	3569	1.84	nd	49.09
Tissue Leaf	20089	2.96	11.46	nd	6.63	193.00	3870	36.29	3.58	58.69
Tissue Skin	9311	10.60	51.60	nd	19.99	185.00	1418	52.70	0.37	157.50
Tissue-Root	6674	6.73	26.20	nd	17.36	426.00	426	33.20	0.28	93.82

nd = Not detected

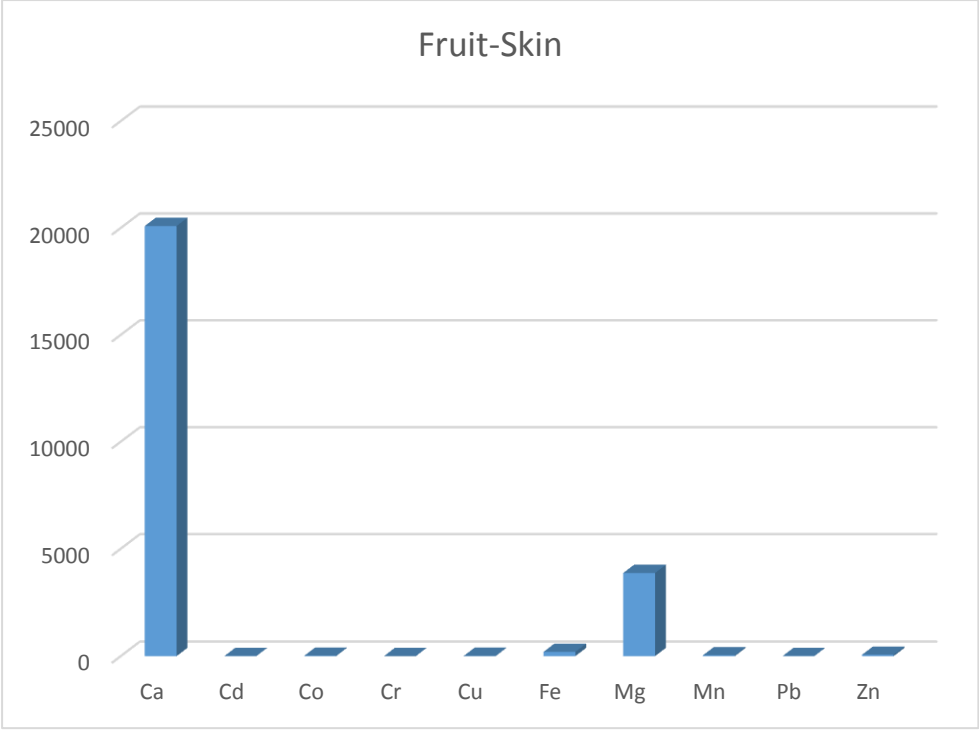

Fig. 5. Showing concentration of elements in fruit skin of Bitter melon.

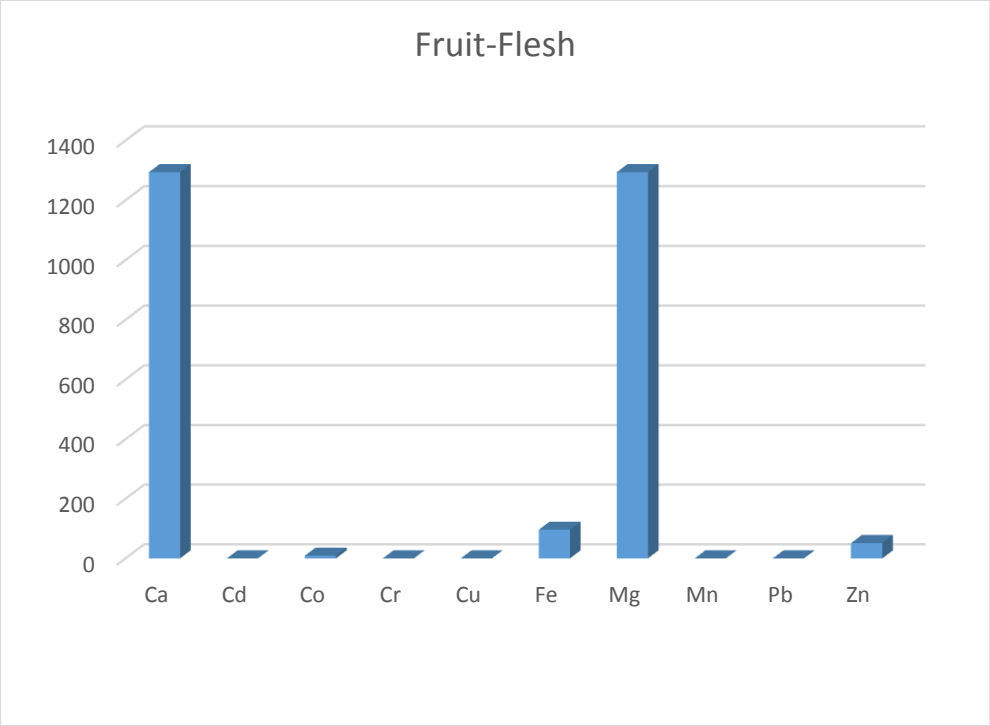

Fig. 6. Showing concentration of elements in fruit flesh of Bitter melon.

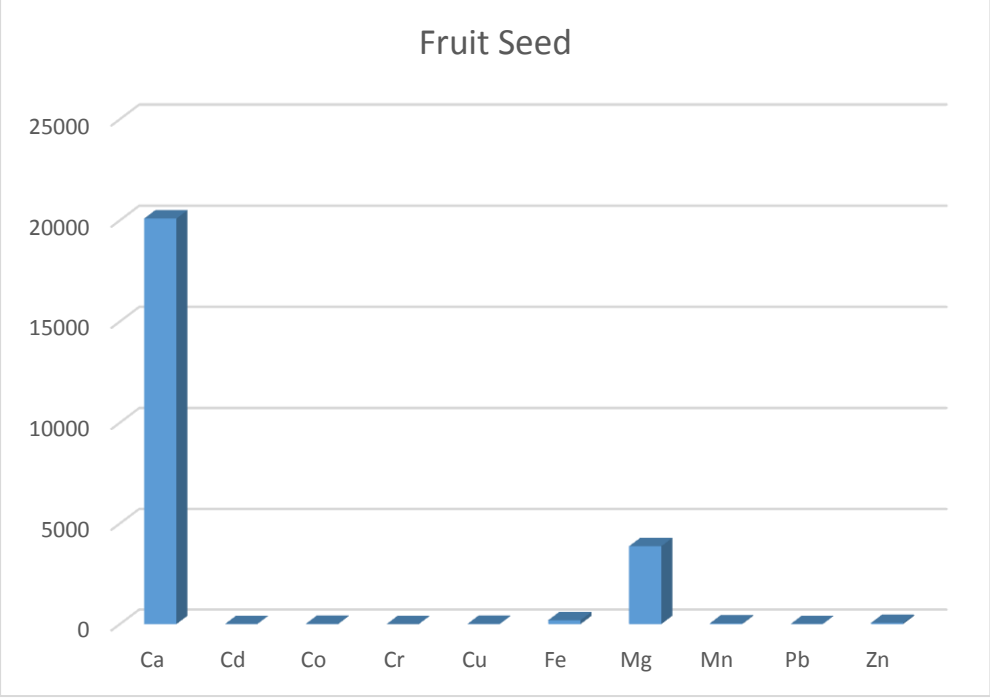

Fig. 7. Showing concentration of elements in fruit seed of Bitter melon.

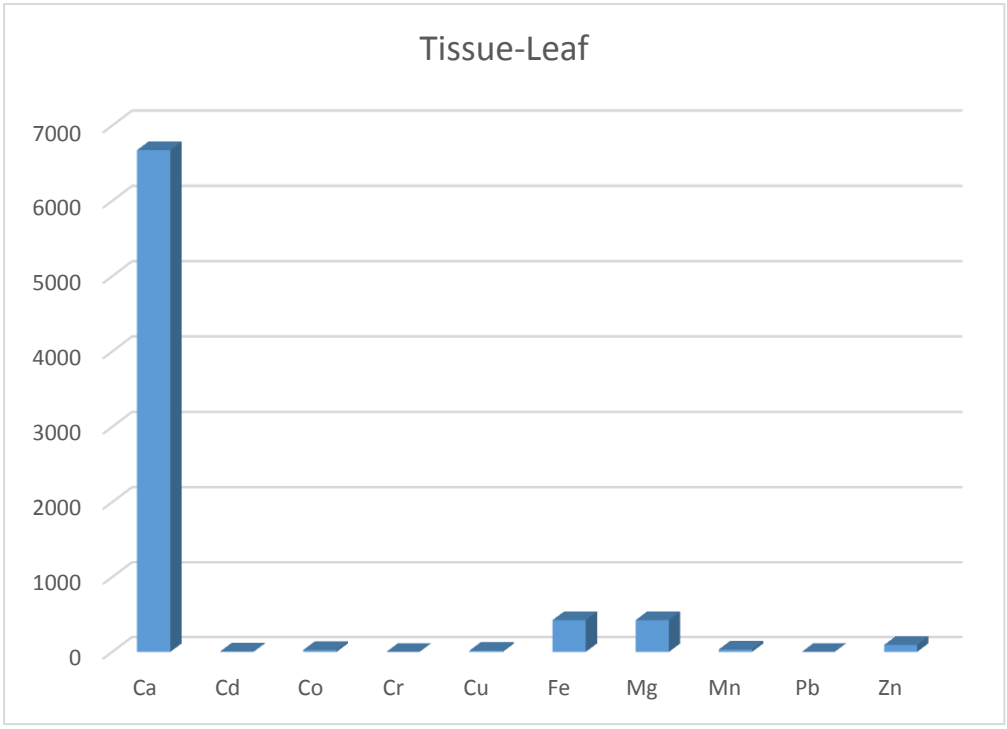

Fig. 8. Showing concentration of elements in tissue leaf of Bitter melon.

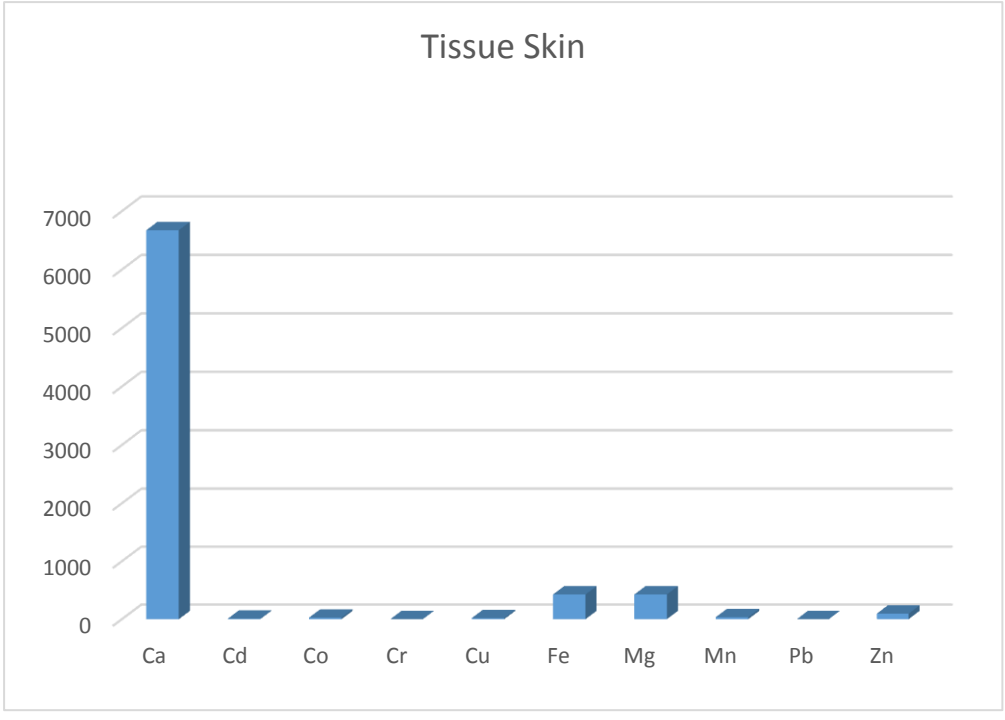

Fig. 9. Showing concentration of elements in tissue skin of Bitter melon.

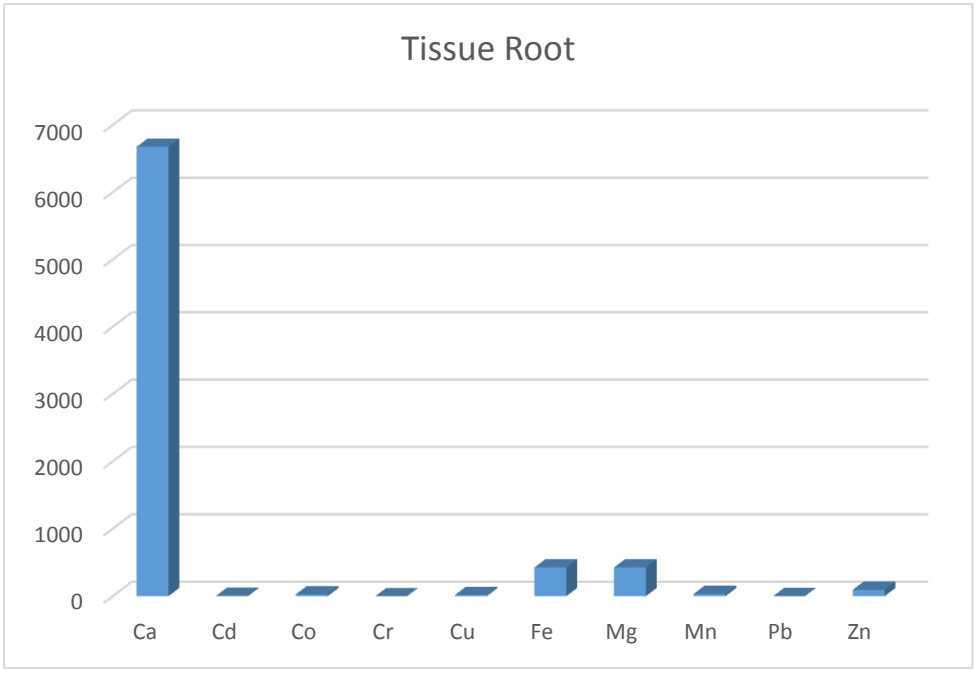

Fig. 10. Showing concentration of elements in tissue root of Bitter Melon.

The fine power of each sample was prepared one by one by grinding using a mortar and pestle. 5.0 g of each powder sample was taken in five conical flasks to digest in aqua regia i.e. 75 ml of Conc. HCl and 25 ml of Conc. HNO_3. The flasks containing samples were placed on a heater at a temperature of 50 °C and kept observation to look for complete digestion which took 45 minutes. All digested samples were allowed to cool by normal way to the room temperature and then added some deionized water to make the total volume of each sample of 100 ml. These samples were used to record the flame atomic absorption spectra.

The other samples were placed in the oven again at a temperature of 100 °C for 60 minutes to get dried fully.

One by one the sample flask (test solution) was connected to the tubing of the nebulizer to proceed to supply the sample in the flame.The other necessary settings were made and then the spectral data were recorded.

3. RESULTS AND DISCRIPTION

The recorded data are given in Table 1 and Table 2 which are self- explanatory. It is found that the calcium has the highest concentration in all parts of the fruit and the tissue. It can be considered as a good source for covering the shortage of calcium in human body to make bones strong enough. The high level of calcium is depicted in Figures 5. It is also remarkable that the tissue leaf has the highest concentration and further the tissue skin and tissue root have quite high concentration of calcium. This may be the region that in many parts of the world, these parts are in use one way or the other.

The next element which is found of quite high concentration is the magnesium in most of the parts which are shown in the Table 2 and depicted in Figures 5.

The magnesium is an essential nutrient for body for healthy bones and blood vessels, muscle and energy formation. Thus the bitter melon can be used as a natural source to meet any such shortage. The level of concentration of iron is also sufficient in most of the parts of bitter melon as shown in Table 2 and depicted in Figures 5, 6, and 7.

The elements such as cadmium and lead which need precautions to use were also investigated and their level were found zero or near to zero and therefore the bitter melon is safe for human consumption. In addition to these elements potassium (K), nitrogen (N) and phosphorus (P) were also investigated and their presence were of very little which are shown in Table 1. The concentration of some of the elements are found different from the earlier reported values in reference [9]. The reason may be the different soil structure and environmental effects.

4. CONCLUSION

From this investigation it shows that all parts of the fruit and tissues of bitter melon are safe and useful for human consumption.

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