

Photochemical Studies of *Solanum Melangena* (Eggplant) Fruit by Flame Atomic Absorption Spectrometry

Rayann Persid, Vishwa N. Verma*

Department of Chemistry, Faculty of Natural Sciences, University of Guyana,
Turkeyen Campus, Georgetown, Guyana, South America

*E-mail address: professorverma@ymail.com

ABSTRACT

Solanum melangena (eggplant) belongs to Solanaceae family. The common name of this fruit and the plant is the same. It has different names in different countries such as eggplant, brinjal, baigan, balangie etc. Eggplant has been reported as a healthiest fruit due to the chemical constituents. The shape, size and colour of the fruits are also different. The genetically engineered eggfruits are also available. Some research works on eggplant are reported in different countries for different purposes. The present study has been taken into an account for the chemical elements present in flesh, skin and the seeds of eggplant grown in the soil and environmental conditions of Guyana. The investigation by the flame atomic absorption photometry shows the presence of Ca, Cd, Co, Cu, Fe, Mg, Mn, Pb and Zn at a varying concentrations in flesh, skin and seeds. In general the presence of calcium and magnesium as the higher values out of which concentration of calcium is 1366mg/kg in skin and magnesium as 2466 mg/Kg in seed.

Keywords: *Solanum melangena*; Eggplant; Elemental Analysis; AAS

1. INTRODUCTION

Solanum melangema belongs to Solanaceae family. The common name for the plant and the fruit is the same. The eggplant is known by different names in different countries as brinjal (England), baigan (India), balangie (Guyana) and many more names all over the world. There are now genetically engineered eggplant. The skin of the eggplant is of many colours but the purple, green and white are more common.

Eggplant is used for treatment of many diseases, including diabetes, arthritis, asthma and bronchitis as reported [2]. Research has focused on an anthocyanin phytonutrient found in eggplant skin called nasunin which is a potent antioxidant and free radical scavenger that has been shown to protect cell membranes from damage but at the same time it has also been reported that the eggplant contain measurable amount of oxalates which develops problems in kidney and gallbladder [3,4].



Fig. 1. Eggplant Fruit.

Distribution of hydroxycinnamic acid conjugates in fruit of eggplant is reported in literature [5]. Changes in the chemical composition of eggplant fruits during development and ripening have been reported with some changes [6]. The following table shows the high rating of the eggplant fruit for many chemical constituents. The photochemical studies for similar vegetables such as Cucurbitae Maxima [7] and Cucurbitae pepo [8] are also available in literature.

Table 1. Showing some nutrients in eggplant fruit.

Eggplant, cubed, cooked				
1.00 cup				
99.00 grams				
Calories: 35				
GI: low				
Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
fiber	2.47 g	9.9	5.1	very good
vitamin B1	0.08 mg	6.7	3.5	very good
copper	0.06 mg	6.7	3.5	very good
manganese	0.11 mg	5.5	2.9	good
vitamin B6	0.09 mg	5.3	2.8	good
vitamin B3	0.59 mg	3.7	1.9	good
potassium	121.77 mg	3.5	1.8	good
folate	13.86 mcg	3.5	1.8	good
vitamin K	2.87 mcg	3.2	1.7	good
World's Healthiest Foods Rating	Rule			
excellent	DRI/DV \geq 75% OR Density \geq 7.6 AND DRI/DV \geq 10%			
very good	DRI/DV \geq 50% OR Density \geq 3.4 AND DRI/DV \geq 5%			

Table 2. Daily requirement of the elements.

Elements	Amount	Elements	Amount	Elements	Amount
Ca	1300 mg	Cr	35 mcg	Cu	900 mcg
Fe	8 mg	Mg	320 mg	Mn	1.8 mg
Ni	1 mg	Na	2.3 g	Se	400 mcg
Zn	8 mg				

Recommended by Institute of Medicines, Food and Nutrition Board (mcg = microgram)

2. EXPERIMENTAL

2. 1. Description of experiment

The eggplant fruit was collected from a farm in lot 340 Union No 30 village, West Coast Berbice, Guyana. It was washed with deionized water. The skin, flesh and seeds were Separated carefully using a plastic knife. 5 g fo flesh, 5g of seed and 5 g of skin were in separate crucibles in an oven keeping thetemperature around 100 °C. The seeds took about 30 minutes, the skin took about one hour and flesh took about 2 hours to dry.

The powder of these dried samples were prepared separately using the mortar and pestle. 1.0 g of the powder was digested into aqua regia (mixure of Conc. HCl and Conc. HNO₃ in the volume ratio of 3:1) i.e. 75 ml conc. HCl acid and 25 ml conc. HNO₃ acid in a conical flask. Then it was placed on a heater on a temperature of 50 °C so that it can dissolve properly. It took nerally 40 minutes.

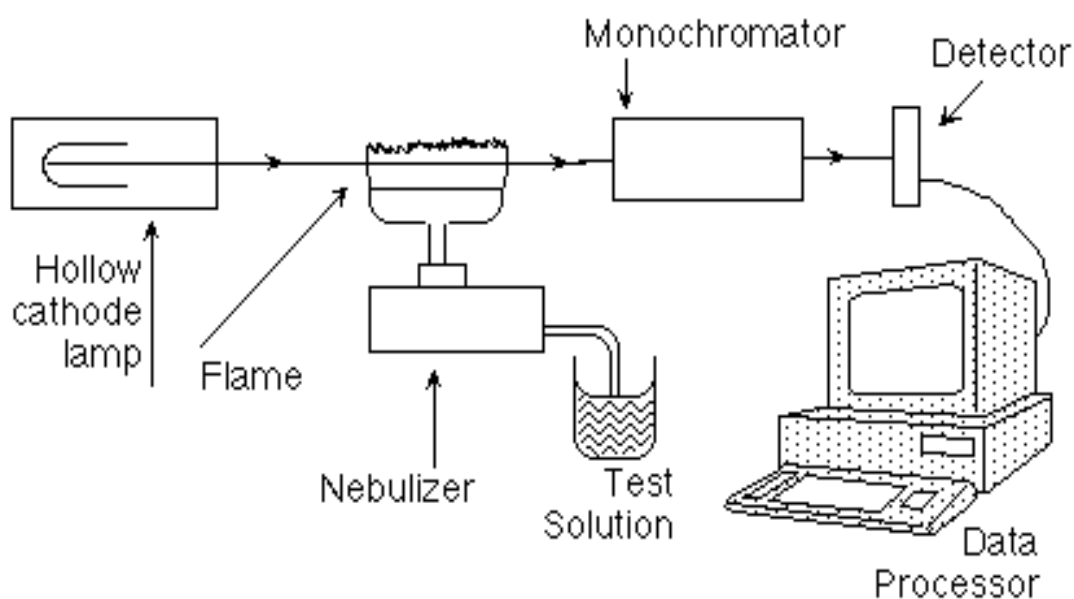


Fig. 2. Schematic diagram of AAS experimental setup.

The access acids were evaporated during this process. The deionized water was added to make the total volume of 250 ml. Thus the sample was now ready to record the flame atomic absorption record. Similar procedure was adopted for the skin and the flesh. The standard solutions of different concentrations were prepared for different atoms. The correlation curves give the concentration of the sample under investigation.

The atoms for most AA elements cannot exist in the free, ground state at room temperature and therefore heat must be applied to the sample to break the bonds combining atoms in molecules. In flame atomic absorption spectroscopy a liquid sample is aspirated and mixed as an aerosol with combustible gases (acetylene and air or acetylene and nitrous oxide). The mixture is ignited in a flame of temperature ranging from 2100 to 2800 °C (depending on the fuel gas used). During combustion, atoms of the element of interest in the sample are reduced to the atomic state.

The characteristic wavelengths are element specific and accurate to 0.01-0.1 nm. Line source lamps emit very narrow bands of radiation. The most common source is the hollow cathode lamp (HCL). The lamps are encased in a cylinder made of glass and a quartz end cap. These cylinders are filled with a noble gas (Ne or Ar) to a pressure of 1-5 torr. The HCLs also contain a tungsten anode, a cathode is made of the metal of interest. Lamps of multi-element in their cathode are also available. But most FAAS instruments can only measure one element at a time.

To provide element specific wavelengths, a light beam from a lamp whose cathode is made of the element being determined is passed through the flame. A device such as a photomultiplier can detect the amount of reduction of the light intensity due to absorption by the analyte and this can be directly related to the amount of the element in the sample. Only those atoms that are the same as those in the lamp will absorb the light from the lamp. A reduction in the amount of light reaching the detector is seen as a measure of the concentration of that element in the original sample.

Table 3. Concentration of different elements in flesh, skin and seed of eggplant fruit.

Sample Description	Parameter								
	Ca	Cd	Co	Cu	Fe	Mg	Mn	Pb	Zn
	(mg/Kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/Kg)	(mg/kg)	(mg/kg)	(mg/Kg)	(mg/Kg)
Egg Plant Flesh	1258	2.49	9.5	8.4	63.4	1884	13.4	3.24	21.4
Egg Plant Skin	1366	1.80	16.2	17.8	100.0	2065	16.9	2.44	28.4
Egg Plant Seed	520	2.20	8.5	19.1	123.0	2466	45.6	2.68	38.2

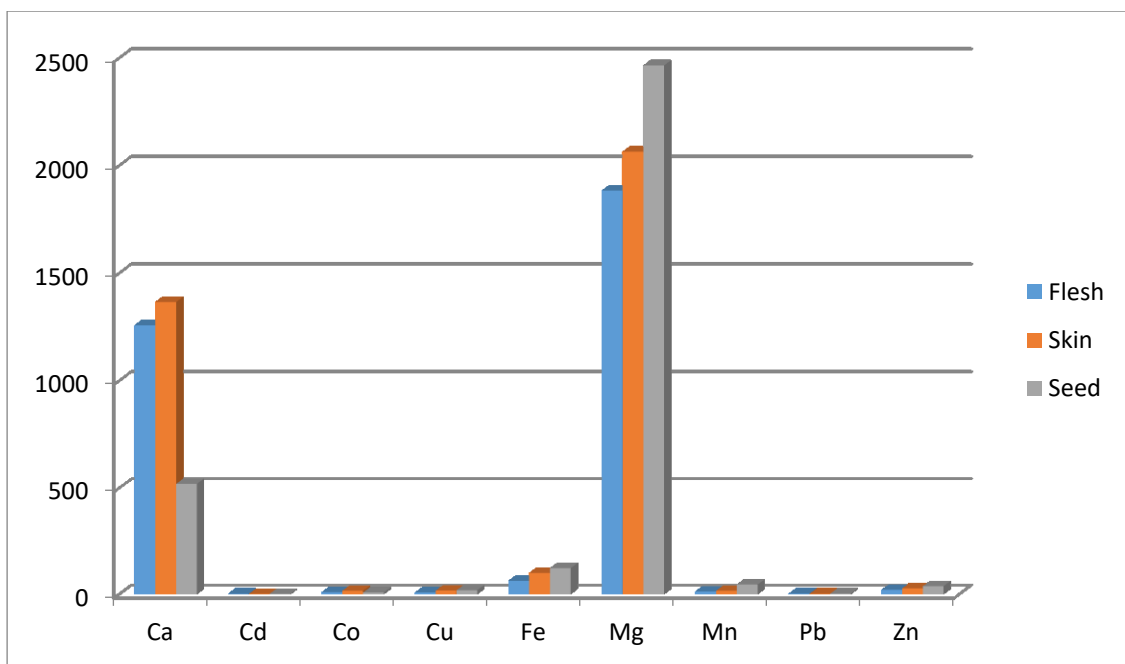


Fig. 3. Showing concentration of different elements in flesh, skin and seed of eggplant fruit.

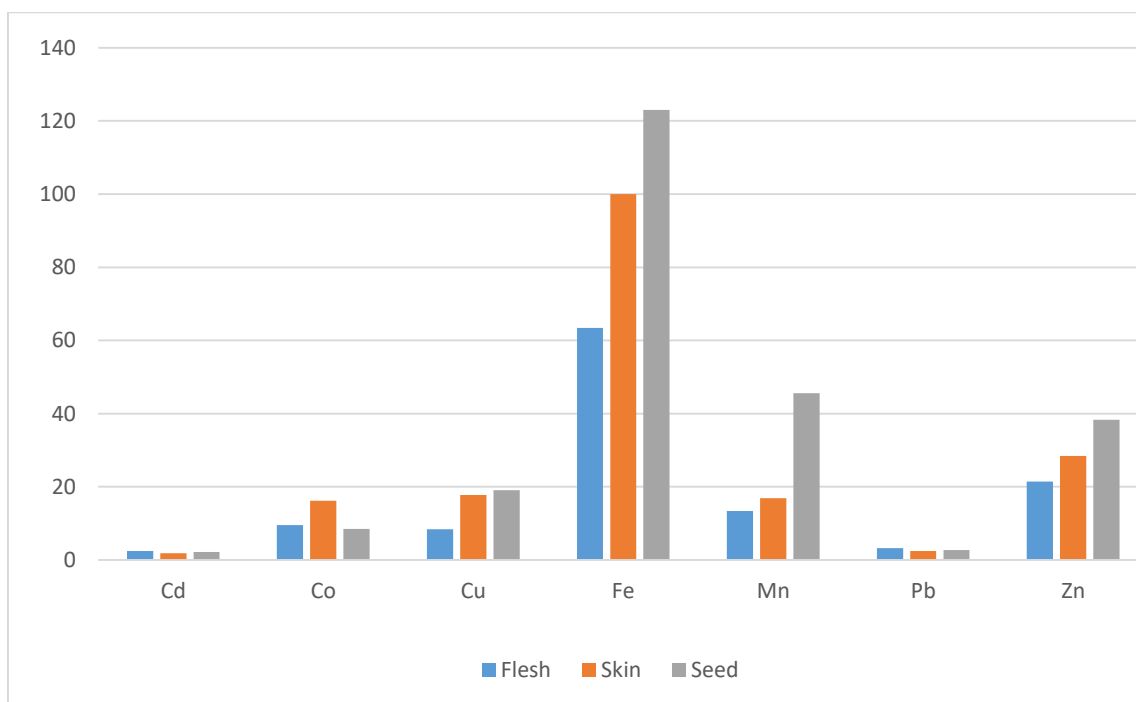


Fig. 4. Showing concentration of elements except magnesium and calcium in eggplant fruit.

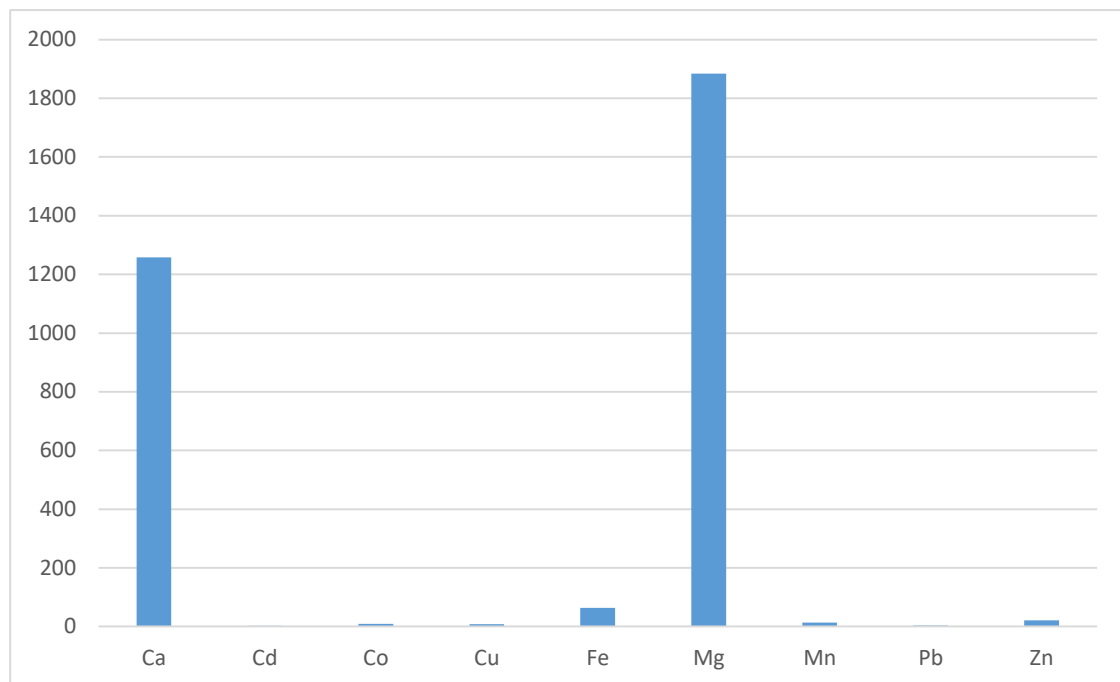


Fig. 5. Showing the concentration of elements in flesh of eggplant fruit.

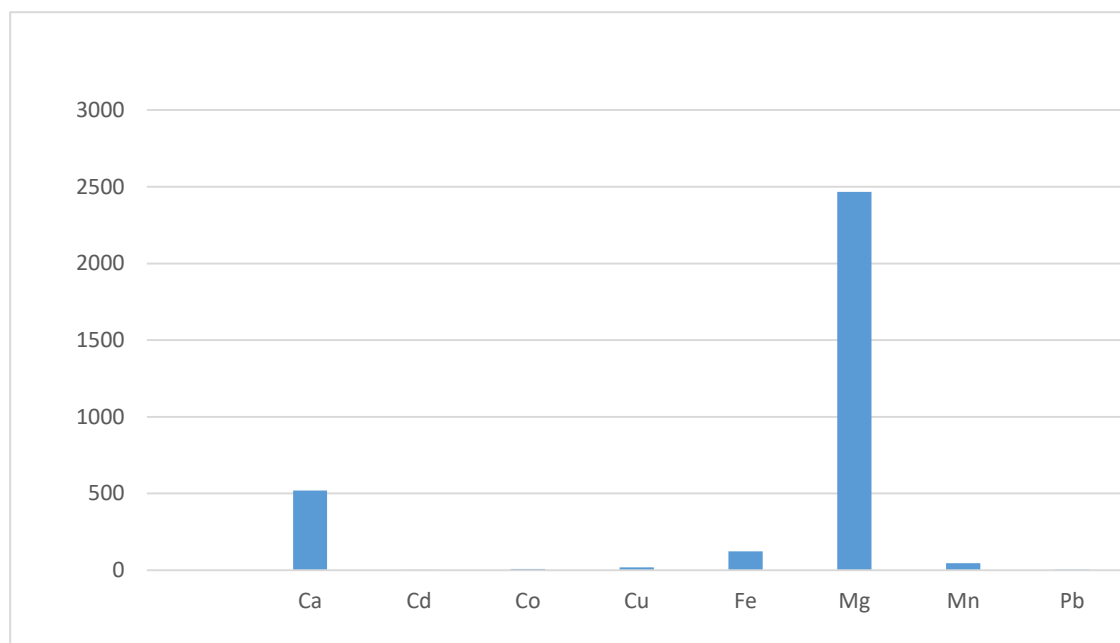


Fig. 6. Showing concentration of element in skin of eggplant fruit.

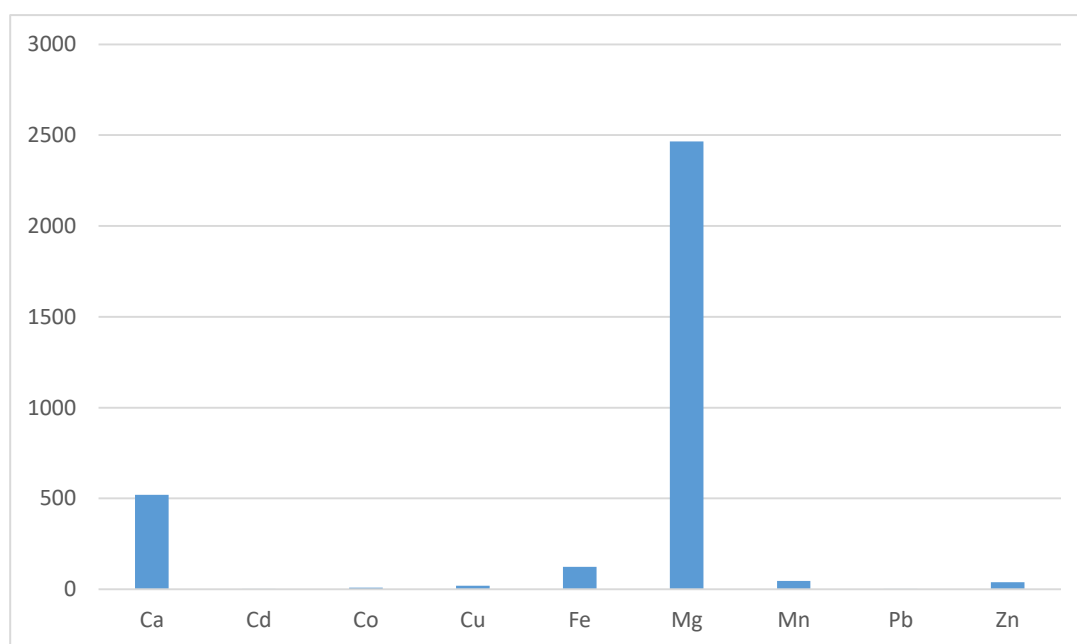


Fig. 7. Showing concentration of elements in seed of eggplant.

3. RESULT AND DISCUSSION

3. 1. Description of results of investigations

Table 2 and the different graphs shown for the data clearly show that the eggplant fruit has the ability to accumulate a quite good amount of calcium as 1258 mg/Kg in flesh, 1366 mg/Kg in skin and 520 mg/Kg in seed which indicate a good source for human consumption and health as essential for developing and maintaining healthy bones and teeth, assists in blood clotting, muscle contraction, nerve transmission, oxygen transport, cellular secretion of fluids and enzyme activity and optimal intake helps to reduce the risk of osteoporosis. Similarly the magnesium which has an importance role as an activator over 100 enzymes and helps nerves and muscles function, maintain the integrity of cell membranes and stabilizes the cell electrically for critical for the heart function has been found in this investigation to a high levels in flesh as 1884 mg/Kg, 2065 mg/Kg in skin and 2466 mg/Kg in seed and thus the consumption is highly recommended. The other elements are of very little amount and no way harmful in use.

4. CONCLUSION

It seems that eggplant fruit is a wonderful fruit provided by nature and can be used without any side effect in general for human beings.

ACKNOWLEDGEMENT

The basic preparations of the samples were done in our laboratory of the Department of Chemistry where the necessary facilities were arranged. Further the authors are grateful to the staff members of the Analytical Research Laboratory, LBI, GUYSUCO for providing the facilities to record the atomic absorption spectra of the samples.

References

- [1] C.F. Timberlake, *Recent Advances in the biochemistry of fruits and vegetables*, New York Academic Press (1981) 221-247
- [2] M.E. Silva, R.C. Santos, M.C. Leary, *Brazilian Archives of Biology and Technology* 42(3) (1999) 339-342
- [3] <http://www.whfoods.com/genpage.php?tname=foodspice&dbid=22>
- [4] Y. Noda, T. Kneyuki, K. Igarashi, *Toxicology* 148(2-3) (2000) 119-123
- [5] B.D. Whitaker, J.R. Stommel, *J Agric Food Chem.* 51(11) (2003) 3448-3454
- [6] E.M. Esteban, E.M. Molla, L.M. Robredo, F.J. Lopez-Andreu, *J. Agric. Food Chem.* 40(6) (1991) 998-1000
- [7] V. Mohabir, V.N. Verma, *I.J.A.R.* 4 (2012) 199-203
- [8] S. Harichan, V.N. Verma, *International Letters of Chemistry, Physics and Astronomy* 2 (2013) 11-17

(Received 22 September 2014; accepted 02 October 2014)