Environment Conservation Journal 9(3) 7-10, 2008
(ISSN 0972-3099)

Spectrophotometric determination of manganese (II) in *Sida spinosa* Linn.

Juhi Agrawal, Sanjeev Kumar, Kumresh Kumar and Rashmi Sharma
Department of chemistry, Gurukula Kangri University, Hardwar (Uttarakhand)

Abstract

Manganese is of universal occurrence in plant and has been identified as forming metallo-enzymes as superoxide dismutase (mitochondrial), arginase, pyruvate carboxylase and glycosyl transferase. It also appears to be directly involved in the enzymic machinery of carbohydrates metabolism with a possible link to lipid metabolism. It is also essential for normal bone structure, reproduction and the normal functioning of central nervous system (Bhagi and Chatwal, 2003).

Knowing the biological significance and uses of this essential ultra trace metal, it was determined spectrophotometerically in the various parts viz; stems, roots, leaves, seeds and flowers of the medicinal plant *Sida spinosa* Linn. The method used is simple, sensitive, selective and economical which is based on the oxidation of small amounts of manganese present in the drug either by potassium peroxide or ammonium persulphate. The former is usually preferred since it gives a true permanganate colour. Here manganese converts into potassium permanganate in acidic solution and absorbance for the colour thus obtained is compared with the concentration absorbance curve of the various dilutions of the standard solution, for calculating the concentration of manganese in the various parts of the plant understudy (Peach and Tracey, 1939). The concentration of manganese in the various parts of *Sida spinosa* thus calculated is 2.4 ppm in stems, 1.4 ppm in roots, 1.1 ppm in leaves, 3.7 ppm in seeds and 4.6 ppm in flowers.

Keywords:- *Manganese, Metallo-enzyme, Oxidation, Sida spinosa, Spectrophotometric study*

Introduction

Sida herbs (Bala) were used over 2000 years ago by ancient peoples in the traditional system of medicine. In India *Sida* species generally occur as weeds of waste places, open scrub forests and along road sides through the tropical and subtropical plains. Some of these species including *Sida acuta* Burm.f., *S. humilis* Wilid., and *S. spinosa* Linn. were used in the ancient system of medicine for a varity of therapeutic purposes (Sen Gupta, 1984; Sivarajan and Balachandran, 1994). Antipyretic, antirheumatic, antimicrobial, antitumor and anti-HIV activities of *Sida* species have been reported (Sen Gupta, 1984), along with several well known therapeutically active phytochemical such as β-phenethylamine, ephedrine, ψ-ephedrine, N-methyl-ψ-ephedrine, N-methyl ephedrine, vasicinol, vasicinone, vasicine, choline and betaine. Thus, the genus *Sida* possesses great potential for the development of various formulations on modern parameters. The mineral elements present in the animal body are essential for various body functions. The importance of the inorganic salts can be understood from the fact that salt starvation causes death much earlier than food starvation (Chatterjee, 1972). Most of the medicinal herbs have been found to be rich in one or more elements under study. Elemental analysis of some herbal plants used for the control of diabetes has been done by the techniques of Neutron Activation Analysis (NAA) and atomic Absorption Spectroscopy (AAS). The elements Mn, Cl, Al, Cu, Pb, Ni, Cr, Cd, Fe, Ca, Zn and Hg were found to be present in different plants in various proportions. Calcium is essential for functional integrity of nervous, muscular and skeletal systems. Magnesium is necessary for proper functioning of over 300 enzymes

including several in glycolysis and Krebs's Cycle. Phosphate is necessary for bone formation, for maintaining calcium balance and for the metabolism of carbohydrates. Potassium and chloride ions are important components of all biological fluids. Zinc is an essential element of nutrition and is a versatile component of metallo-enzymes. Copper is necessary for proper functioning of many metallo-enzymes. Manganese is necessary for normal bone structure, reproduction and normal functioning of Central Nervous System. Above examples are just good enough to highlight the importance of minerals in biological syatem (Bhagi and Chatwal, 2003). Determination of mineral elements in 16 medicinal plants including *Sida rhombifolia* have been carried out using AAS, ICP and flame photometer. Mineral elements Ca, Cu, Fe, Mg, Zn, Ba, K, Na and Al were common in all the medicinal plants analysed, which directly relate their importance in the maintenance of health, and for the treatment of cough and vomiting, pyorrhea and rheumatic and allied disorder (Jain *et al.*, 1993; Nandkarni, 1976). Only elemental findings were reported on *Sida* species. In the light of the above and in continuation of previous work, we reported here-in the spectrophotometric determination of manganese (II) in the various parts of the medicinal plant *Sida spinosa* Linn.

Materials and Method

The plant used for the study was collected from the different localities of Uttarakhand and Utter Pradesh in the month of June to November in the year 2004, 2005 and 2006. It was then identified with the scientific literature and also by matching with the authentic herbarium specimen preserved at Botanical Survey of India (Uttarakhand). Various parts of the plant were washed to remove all the foreign matter from the material, air dried ground and stored in tightly stoppered bottles until needed for analysis. Systronics U.V. visible spectrophotometer 117 equipped with 1.0 cm quartz cells was used for all absorbance measurements.

Standards and sample solutions of different parts of the plants were prepared by following the literature procedure (Paech and Tracey, 1939). The dried sample (1-5 gm) contained in a 500 ml kjeldahl flask is moistened with nitric acid and 10 ml of sulphuric acid . Heat gently and then boil. Add nitric acid in small quantities (about 1 ml) until oxidation of organic matter is completed. Evaporate until sulphuric acid fumes appear. Add 1 gm of potassium persulphate, dilute with approximately an equal volume of water and heat until white fumes again appear. Allow to cool and transfer after dilution to a 250 ml conical flask, total volume after washing-out should be 100 ml. Boil for a few minutes. After cooling add 3 ml of phosphoric acid (85%) and 0.3 gm of potassium periodate. Boil for a few minutes and place in a boiling water bath for 15-30 min to develop full colour of potassium permanganate. Cool and dilute to a suitable volume (e.g. 200 ml) and note down the absorbance with the help of U. V. spectrophotometer to calculate the concentration with the help of absorbance-concentration curve of the standard.

A standard solution can be prepared by dissolving 0.2878 gm of pure potassium permanganate in 250 ml water in a 1 liter volumetric flask; adding 20 ml concentrate suphuric acid and sodium metabisulphite solution slowly until the solution becomes just colourless. Any excess of sulphur dioxide can be removed by addition of a few drops of nitric acid. Dilute to 1 litre (1 ml= 0.1 mg Mn). To prepare standard solution, put appropriate amount of this manganous sulphate solution into volumetric flask, add 10 ml sulphuric acid and 3 ml phosphoric acid. Dilute to about 60 ml add 0.3 gm potassium periodate and proceed as above. When the colour is fully developed, cool and make volume 1 liter.

Results and Discussion

Mean absorbance for various dilutions of standard solution was measured which is graphically presented in Fig.1 and tabulated in Table-1. The absorbance of sample solution was referred to the calibration plot and the amount of manganese was determined in each of the sample. The results are depicted in Table-2. The value of manganese is found to be higher in flowers (4.60 ppm) and very low in leaves (1.10 ppm) and root (1.4 ppm). Quantity of manganese is found to be moderate in stems and seeds, which is 2.4 ppm and 3.7 ppm respectively.

Table-1: Mean absorbance shown by standard solution at different dilution

Sample Label	Concentration (mg/l)	Mean Absorbance (nm)
Blank	-	0.000
Standard 1	0.800	0.020
Standard 2	1.600	0.042
Standard 3	2.400	0.064
Standard 4	3.200	0.083
Standard 5	4.000	0.102
Standard 6	4.800	0.125

Table-2: Mean absorbance shown by different manganese sample

Sample Label	Concentration (mg/l)	Mean Absorbance (nm)
Sample 1	1.400	0.036
Sample 2	2.400	0.062
Sample 3	1.100	0.026
Sample 4	3.700	0.096
Sample 5	4.600	0.120

Sample 1- Root sample, Sample 2- Stem sample, Sample 3- Leave sample, Sample 4- Seeds sample, Sample 5- Flower sample

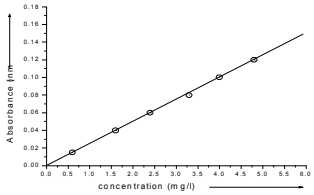

Fig.1: Calibration curve for manganese (II)

Acknowledgement

We are thankful to the Department of Chemistry and the authorities of Gurukula Kngri University, Haridwar for providing the necessary facilities required for this study. Identification of the plant species by the Botanical Survey of India (U.K.) is gratefully acknowledged.

References

Bhagi, A.K. and Chatwal, G.R., 2003. *Bioinorganic and supramolecular chemistry.* Himalayan Publishing House. pp:

Chatterjee, C.C., 1972. *Human Physiology*. Vol-I, New Central Book Agency, Calcutta.

Jain, N., Magan, K., and Shondhi, S.M., 1993. Determination of Mineral elements present in medicinal plant used for the development of health, for the treatment of Cough and Vomiting, pyorrhea and rheumatic and Allied disorders. ***Indian drugs***, 30(5): 190-194.

Nandkarni, K.M., 1976. *Indian Materia Medica*. Edited by Nadkarni, A.K., Popular Prakashan Pvt. Ltd. Bombay. pp:

Paech, K., Tracey, M.V., 1939. *Modern Methods of plant Analysis*, Vol-1. pp: 495.

Sen Gupta, N.N., 1984. *Ayurvedic System of Medicine*. Neeraj Publication House Delgi, Vol-2. pp:

Sivarajan, V.V., Balachandran, I., 1994. "*Ayurvedic Drugs and their Plant Source*" Herbal Garden, Arya Vaidyasala, Kottakkal, Kerala, Oxford and IBH Publishing Company, New Delhi. pp:129-141.