



ISSN No: 0975-7384
CODEN(USA): JCPRC5

J. Chem. Pharm. Res., 2011, 3(3):64-68

Study of the trace elements in *Aloe vera* L. (*Aloe barbandensis* Miller) viz. Liliaceae and its biological and environmental Importance

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ABSTRACT

The mineral are usually required in small amount for the development of the plants and organisms. Excessive uptake of these trace elements by plants affects the metabolic activities of plant as well as animals. However these metals also play an important role in control of many diseases in humans. In the present study an attempt has been made to analyse the trace elements in the Aloe vera L. (Aloe barbandensis Miller) viz. Liliaceae leaves from the three locations namely Aligarh, Bareilly and Haridwar region of India. The concentration of Na, K, Ca, Mg, P, Fe, Cu, Zn, Cd and Pb were found quit high in all the samples. It also can be used as herbal drug deciding the dosage of herbal drug preparation. Results also reveal that the Aloe vera can be used as a good treatment option for waste water and polluted soil because it absorbs trace elements from the soil.

Keywords: Metals, metabolic, drug, trace elements.

INTRODUCTION

Aloe vera is native of the Mediterranean region of southern Europe and North Africa. It is commonly grown in Asia, southern Europe, Mexico and southern America. The medicinal use of *Aloe vera* was already mentioned more than 4000 years ago in a collection of Sumerian clay tables dated 2100 B.C.

Aloe vera acts as a physiological carrier for many active biological agents. Therapeutic uses of *Aloe vera* have been reported in medicinal literature for over 50 years. Recent studies showed that it is being used in the treatment of arthritis, high cholesterol, hypertension, chronic pelvic

pain, immune system disorder and diabetes. [1,2,3,4]. It also reported as a antibacterial and antifungal agent [5, 6]. Modern clinical medical use of *Aloe vera* began in 1930 with reports of successful treatment of x-ray and radium burns [7].

Minerals are nutritive elements which are present in tissues and fluids of all body. They maintain the certain physio-chemical processes, structural components of tissues and as constituents of enzymes in many metabolic pathways [8, 9, 10, 11]. Minerals may be classified as the Macro and Micro nutrient. The macro nutrients are Ca, P, Na, and Cl while micro nutrients are Cu, Co, K, Mg, I, Zn, Mn, Mo, F, Cr, Se, and S [10].

Today there are several medicinal and cosmetic products on the market that contain various amount of juice gel of *Aloe vera*. The *Aloe vera* content has become an important marketing factor which capitalize on the legendary fame of this plant. However there are many aloe products of questionable quality on the market which may in the early 1980's led to the foundation of a product quality certification programmes administrated by IASC (International Aloe Science Council). In March 2009 IASC has certified about 500 finished aloe products and raw materials from more than 80 companies world-wide but there are hundreds of another aloe product on the marked which are not certified [12].

Aloe products have long been used in health foods and for medicinal and cosmetic purposes. These products range from aloe drinks to aloe gels, powders, capsule, creams & oils etc for both external and internal uses for a wide variety of indications. Aloe gel contains phenolic anthraquinones, carbohydrates polymers and various other organic and inorganic compounds. It has a wide range of medicinal application such as wound healing effect, reduces blood sugar levels in diabetes, soothes burning, reduces intestinal problems, stimulates immune response against cancer, reduce arthritis, swelling ulcer curative effect etc [13].

The chemical composition of any plant depends upon the local geographic condition and type of soil. Keeping the above in view the present study was designed to analyse the trace metalion content of *Aloe vera* L. (*Aloe barbandensis* Miller) viz. Liliaceae leaves.

EXPERIMENTAL SECTION

Collection of sample: Mature healthy and fresh leaves of *Aloe vera* were collected from the Nurseries and botanical garden of three cities Site I (Aligarh), Site II (Bareilly) and Site III (Haridwar) in India. Leaves were taken and washed with fresh water.

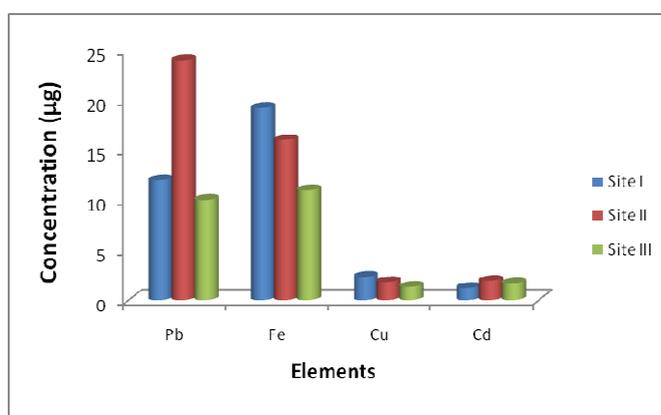
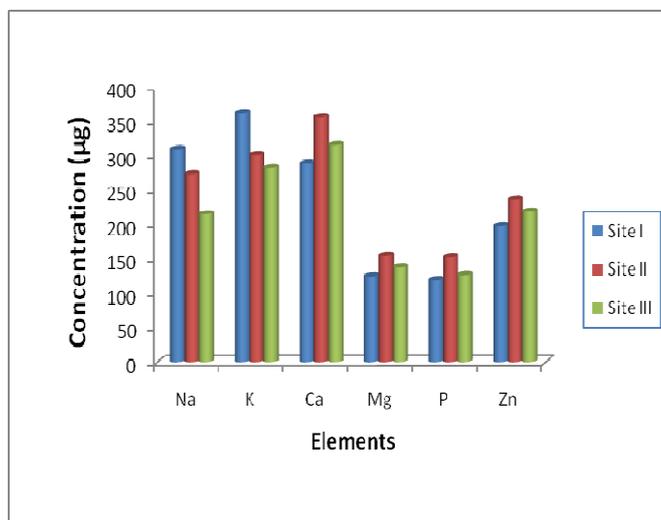
Sample Preparation: The leaves were cut in to pieces and thick epidermis was removed. The solid gel of the leaf was homogenised and dry ashing method was adopted by placing the properly dried and ground plant sample in to the vitresile crucible overnight in an electric muffle furnace maintaining the temperature between 410-440 °C. This ashing will destroy all the organic material from the sample. The ash was removed from crucible and allowed to dry in desicator. The yield of ash was approx. 4 gm/ 100 gm.

Analysis of Sample of trace elements

1 gm of ash was taken and digested using conc. HNO₃, H₂SO₄ and HClO₄ in the ratio of 10:6:3 and dried at 240°C. The digested sample was made up to 50 ml volumetric flask and used for assay of trace elements through AAS (Atomic Absorption Spectrometer) by suitable hollow cathode lamps of Perkin Elmer A Analyst 100. Phosphorus was analysed with colorimeter using ammonium vanadate-molybdate method. Five replicates were prepared for the each sample.

Table 1: Concentration±S.E. of trace elements (μg) in *Aloe vera* L. (*Aloe barbandensis* Miller) viz. Liliaceae

Element	Site I (μg)	Site II (μg)	Site III (μg)
Na	309±11	273±10	215±7
K	362±10	301±18	282±11
Ca	289±6	356±16	315±9
Mg	125±8	155±12	138±6
P	120±10	153±13	127±9
Fe	19.23±1.8	16±1	11±2
Cu	2.34±0.6	1.81±0.8	1.32±0.3
Zn	198±6	236±11	219±10
Cd	1.2±0.1	1.93±0.4	1.67±0.6
Pb	12±2	24±3	10±1

**Graph:1 Concentration of micro minerals in *Aloe vera* leaves of study sites****Graph:2 Concentration of macro minerals in *Aloe vera* leaves of study sites**

RESULT AND DISCUSSION

The results show that 10 elements viz Na, K, Ca, Mg, P, Fe, Cu, Zn, Cd, and Pb which have been found in a high concentration in all the samples (Table 1). Comparative differences were found in all elements at all the study site samples. Each element has an important role in the structural

and functional integrity of the living cells and organisms. The importance of trace element in living organisms was first showed over a century ago. The existence of a number of trace metals containing enzymes was also demonstrated by Claude Bernard and Mcmum. Studies in humans and animals showed that optimal intake of trace elements like Cu, Zn, Na, Mg, Ca, Cr, and I can reduce individual risk factors. The role of inorganic elements like Cr, Zn, Fe, Cu, and Mn also improved the impaired glucose tolerance and their indirect role of management of diseases diabetes mellitus.

Magnesium is one of the important mineral which takes part in the Carbohydrate and fat metabolism. In the deficiency of this element there is a chance of diabetes mellitus because it also plays role in the release of insulin.

Zn is a versatile element which has been well known to be an important trace element in diabetes as a cofactor for insulin. Zn also enhances the effectiveness of insulin [14].

Potassium is necessary for the optimal insulin secretion [15]. Potassium deficiency results more after from excessive losses than from deficient intakes. Potassium depletion can result in reduced glucose tolerance. Potassium and Sodium plays important role in the diseases related to the renal disorder [16].

Fe has several vital functions inside the body of animal and plants as well which involves in oxidation-reduction reactions (ETC), haemoglobin- oxygen transport and transport and also a cofactor for numerous other enzymes. Studies in experimental animals have clearly shown that iron deficiency has several negative effects on important functions of body.

Copper is also serve as constituents of many enzymes which contain copper in the active sites and catalyse the oxidation reactions. It plays a key role in the haemoglobin synthesis [13]. Trace elements present in *Aloe vera* have a significant antidiabetic activity [3].

CONCLUSION

The presence of all the essential elements in *Aloe vera* may readily account for the most of the therapeutic efficiencies. The identified compounds play important role in the insulin secretion of the body. Although some elements also absorbed but with suitable techniques it can be used for various diseases as a safe and useful drug. As it is also used as herbal drug *Aloe vera* will be useful in decidly the dosage of herbal drugs prepared from these variety for the management of diseases related to metabolic disorder.

The data obtained from the present study also shown that this plant is a good absorber of many metals therefore it can also be used for the removal of heavy metal from the soil and waste water.

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