Eichhornia crassipes a Suitable Economic Feed: 
The World’s Worst Aquatic Weed

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Abstract: The present study deals with the feed potential of aquatic macrophyte Eichhornia crassipes which is considered as the world’s worst aquatic plant by the analysis of minerals. The elemental analysis revealed that the studied plant was characterized by its high value of nitrogen, potassium, iron and manganese. The Ca/P ratio that constitutes an important parameter when plant considered for use as feed source was found to be within range. In addition, the nutritional components i.e., moisture and energy contents of the plant were also determined.

Key words: Aquatic weed, calorific value, Eichhornia crassipes, minerals, microelements, macrolelements, water hyacinth

INTRODUCTION

It is estimated that there are 2,50,000-5,00,000 species of plants on earth (Borris, 1996). A relatively small percentage (1-10%) of these is used as food by both humans and other animal species. It is possible that even more are used for medicinal purposes and the roles of plant in maintaining human health is well documented (Moerman, 1996). The plants are rich source of minerals. They are obtained from the earth’s crust through the effects of the weather rocks that contain minerals are ground into smaller particles which then become part of the soil. The mineral content in the soil is absorbed by growing plants.

The plants are being eaten by both animals and human beings. In this way minerals become part of the food chain. The plants may absorb so much of the essential elements in the soil in which they are growing that may serve as indicators of the mineralization and are infact used for this purpose (Cannon, 1960). The specific parts of several plants are often used as medicines in the Indian Ayurvedic system.

The high concentration of potassium in the plants could be related to the diuretic action of the drug prepared from the plant materials. The high concentration of calcium ions can explain the absence of side effects as regard stomach lesions (Shailajan et al., 2004; Venketaraman and Krishnan, 2002). A number of metal complexes and ligands have been shown to be chemically useful as antitumor and antiviral agents. Aquatic plants grow profusely in lakes and waterways all over the world and have in recent decades their negative effects magnified by man’s intensive use of natural water bodies. Eradication of the weeds has proved almost impossible and even reasonable control is difficult. Turning these weeds to productive use would be desirable if it would partly off set the costs involved in mechnical removal. Among other uses, there has been considerable interest in using aquatic plants as a source of feed. Since aquatic weeds are known to differ widely in their chemical composition depending upon species, season and location (Anonymous, 1984), an insight into their chemical composition is essential if utilization prospects are to be considered.

Eichhornia crassipes (Mart.) Solms commonly known as water hyacinth belonging to the family Pontederaceae is listed as one of the most productive plants on the earth and is considered the world’s worst aquatic weed (Holm et al., 1977; Westerdahl and Getsinger, 1988; Grodowitz, 1998; Charudattan, 1996). Its habitat ranges from tropical desert to subtropical or warm temperate desert to rainforest zones. It tolerates annual temperatures ranging from 21.1-27.2°C and its pH tolerance is estimated at 5.0-7.5. The beautiful blue devil water hyacinth, recognized by its lavender flowers and shimmering bright leaves is a prolific aquatic plant which spreads at an alarming rate.

The plant is euryhaline, tolerating both fresh and marine water, hence its spread knows no boundaries. Recently considerable attention has been given to

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harvesting this aquatic plant for practical uses to partially defray the cost of removal from waterways and use as economical sources in many parts of the world. The present research was designed to evaluate the mineral contents of the aquatic plant *Eichhornia crassipes*. The Ca/P ratio was calculated. In addition, the moisture and energy content was also determined.

The purpose of this study was to supplement existing knowledge on water hyacinth by elemental analysis to examine its economic suitability. Hence, the study deals with the screening and scientific evaluation of plant minerals that may prove beneficial for the mankind along with the management of the aquatic weed.

**MATERIALS AND METHODS**

Water hyacinth (*Eichhornia crassipes*) plants were collected from the water bodies in Bilaspur district of Chhattisgarh (21°37'-25°7' N latitude and 81°12'-83°40'E longitude). Fresh plants were washed several times under running tap water followed by surface sterilization by Mercuric Chloride (0.01%). The plants were shade dried followed by oven-drying at 50°C for 24 h. Then plant materials grinded to powder and used for further phytochemical analysis. Total nitrogen concentration was determined by the standard micro-kjeldahl method (Black, 1965).

To determine phosphorus, plant extract was prepared by dry ashing and triacid digestion (using nitric acid, sulphuric acid and perchloric acid). Then phosphorus was assayed spectrophotometrically (Snell and Snell, 1953).

For potassium and calcium estimation, plant extracts prepared by dry ashing and diacid digestion (using nitric acid and perchloric acid). Potassium and calcium were determined using Atomic Absorption Spectrophotometer (AAS).

Micronutrients like iron, zinc, copper and manganese were also estimated by AAS. For micronutrients, plant extracts were prepared by wet ashing and diacid digestion (using nitric acid and perchloric acid).

Moisture content of the water hyacinth plant was determined by standard methods of AOAC (1990). Energy content was estimated using digital Bomb Colorimeter following Leith (1968). All the data were subjected to statistical analysis. Observations are shown in tabular form representing the Mean±SD.

**RESULTS AND DISCUSSION**

A total of eight elements Nitrogen (N), Phosphorus (P), potassium (K), Calcium (Ca), iron (Fe”), Zinc (Zn”), Copper (Cu”) and manganese (Mn”) were determined. Elemental composition of water hyacinth is shown in Table 1. The values (on dry weight basis) for nitrogen (%), phosphorus (%), potassium (%) and calcium (%) were 5.21, 0.22, 2.3 and 0.36, respectively. Among the macroelements analysed in *Eichhornia crassipes*, nitrogen was found to be highest whereas phosphorus present in least amount. The results of microelements showed a highest value for manganese (332 ppm of dry weight basis). The least value was found for copper (2 ppm of dry weight basis). The Ca/P ratio calculated as 1.63.

The results of the plant analysis for moisture content and energy content were shown in Table 2. The highest moisture percentage value of 88.315 was recorded for whole plant whereas low value was recorded for the rhizome (79.959%) of dry weight. The plant has a high caloric value of energy as 333 Kcal/100 g of dry weight.

In the present study the value of nitrogen percentage recorded was higher than the value reported by Shashtyar and Haroon (2009) whereas it was lower in case of phosphorus, potassium and calcium. Majid (1983) has also reported N, P and K percentage in the range of 1.50-2.20, 0.37-0.56 and 2.1-3.32%, respectively. The findings support this and suggest that the plant could be used as feed source.

When plants are to be considered for use as a feed source the calcium/phosphorus ratio constitutes an important parameter. This ratio should be within the range of 0.5-2.0 for the healthy growth of animals and should not be >6.0 (Murillo et al., 1987). The ratio of calcium/phosphorus in this study found to be 1.63.

It was reported (Alloway, 1990; Al-Shayab, 2002; Borovik, 1990; Ross, 1994) that iron and zinc contents ranged from 0-1642 and 3-4000 ppm, respectively in medicinal plants. Iron is an important trace element for haemoglobin formation, normal functioning of the central nervous system and in the oxidation of carbohydrates, protein and fats (Adeyeye and Otokiti, 1999). Iron can promote disease eliminating polygyn and hence the plants can be used as very good diuretic agent and also for strengthening the function of stomach.

Analysis of plant revealed the presence of high energy content as 333 kcal/100 g which is higher value than the value 220 kcal/100 g, reported by Aderibigbe and Brown (1993). It may be suggested that the higher levels of elements could be related to the normal physiology of the plant. K and Ca are bulk
Table 1: Values of macro (% of D.wt.) and micro (ppm)-elements of *Eichhornia crassipes*

<table>
<thead>
<tr>
<th>Mineral contents</th>
<th>Observed values</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (%)</td>
<td>5.2±0.594</td>
<td>1.50-2.20</td>
<td>-</td>
<td>-</td>
<td>2.251</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td>0.22±0.110</td>
<td>0.37-0.36</td>
<td>0.37</td>
<td>791 (ppm)</td>
<td>0.28</td>
</tr>
<tr>
<td>Potassium (%)</td>
<td>2.3±0.557</td>
<td>2.1-3.320</td>
<td>3.68</td>
<td>4600 (ppm)</td>
<td>3.48</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td>0.36±0.23</td>
<td>-</td>
<td>1.04</td>
<td>1808 (ppm)</td>
<td>-</td>
</tr>
<tr>
<td>Iron (ppm)</td>
<td>280±1.976</td>
<td>-</td>
<td>-</td>
<td>2557 (ppm)</td>
<td>1152</td>
</tr>
<tr>
<td>Zinc (ppm)</td>
<td>45±0.856</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>56.15</td>
</tr>
<tr>
<td>Copper (ppm)</td>
<td>2±0.670</td>
<td>-</td>
<td>-</td>
<td>20 (ppm)</td>
<td>44.4</td>
</tr>
<tr>
<td>Manganese (ppm)</td>
<td>332±2.450</td>
<td>-</td>
<td>222 (ppm)</td>
<td>524</td>
<td></td>
</tr>
<tr>
<td>Calcium/Phosphorus</td>
<td>1.65</td>
<td>-</td>
<td>2.81</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Mean±SD (n = 6), A (Majid, 1983), B (Anjana and Matai, 1990), C (Aderibigbe and Brown, 1993), D (Sharehar and Huroon, 2009) reported the values for different elements of *Eichhornia crassipes* plant.

Meaningful constituents in human body. They are mainly involved in maintaining acid and base balance in body. Ca is essential for the strengthening of bones and teeth.

**CONCLUSION**

In this study, *Eichhornia crassipes* is a rich source of mineral contents and can serve as suitable economic feed. Because of the rich diversity of this aquatic plant it is expected that analysis for mineral and scientific evaluation of plant may prove beneficial for the mankind along with the management of the weed.

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**REFERENCES**


