NOTES ON UTILIZATION OF WATER HYACINTH (*Eichhornia crassipes*) AS A MEANS OF POLLUTION CONTROL

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ABSTRACT

The potentials of water hyacinth (*Eichhornia crassipes),* a vibrant, prolific, free floating weed which invaded Nigerian waterways almost one and half decades ago cannot be undervalued. This paper presents various ways in which the plant (though a menace in various communities where it exists) can be utilised. Attention is focussed on the analytical investigation of the plant with a view to highlighting its usefulness as an effective mopping agent and scavenger of toxic elements in the nation's aquatic environment where both industrial and domestic effluents accumulate.

INTRODUCTION

Water hyacinth (*Eichhornia crassipes*) Marts (Solms) is a free-floating annual aquatic weed. The plant was reported to be native to South America and possibly some of the Caribbean Islands (Bock, 1966). Its spread to different parts of the world such as United States of America, Bengal, Java, Indonesia, Sudan and Senegal is surrounded with various tales.

Nigeria became a victim of water hyacinth invasions in 1984 when the weed was carried by current into Nigerian waterways from the neighbouring Republic of Benin via Badagry creeks. It has since invaded most of the creeks and inlets, blocking waterways, causing problems in water transportation, fishing and other commercial activities whose survival depend upon water as in Figure 1.

The plant is also a breeding ground for many insects and molluscs which are vectors of diseases like bilharzia, river blindness and malaria (Philip, 1981).

The high infestation of water hyacinth though an economic disaster to Nigeria as a nation, the rapid growth of the plant coupled with its composition could be

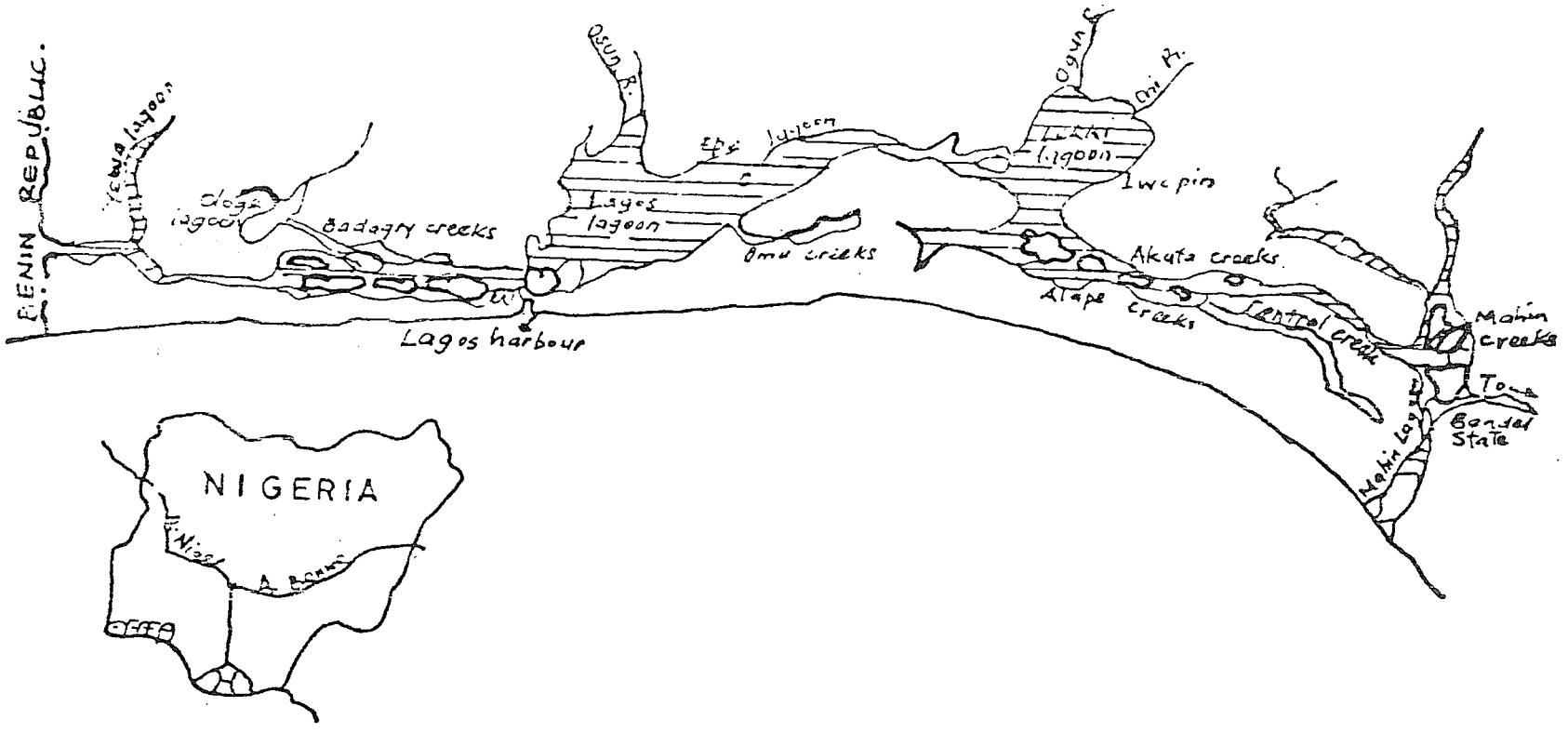

Figure 1.

Lagoons and creeks of Lagos, Ogun, Ondo and Bendel State of South Western Nigeria infested by water hyacinth (inset Nigeria).

Source: Oso (1988)

utilised for some beneficial uses (Ogunlade, 1992). Some of these uses include:

(i) **Animal Feed:** The dearth of animal protein with increasing cost of food production coupled with rapid population growth necessitate the search for non-conventional sources of protein such as leaf protein concentrates (LPC) from water hyacinth (Ogunlade, 1992). The plant in combination with concentrates of other feeds have proved to be of good quality protein source for annual feed (Oke, 1973).

(ii) **Paper and Board Manufacture:** Since water hyacinth gives an easily digestible pulp, it serves as a readily available raw material for manufacturing of paper and boards. This has been substantiated by various works (Hannah, 1988; Udohitinah and Aladesulu, 1988).

(iii) **Biogas:** The incessant shortage of petroleum products especially cooking gas and fuel can be a thing of the past, if water hyacinth can be fully utilised as biogas. Haripada *et al* (1983) reported that the leaves, which constitute greater effective mass than, stalk and root, could be used for gas production. Also, Faborode (1988) reported the use of briquettes and wafers made from water hyacinth from domestic and rural agro-industrial fuel applications.

(iv) **Fertilisers:** The C/N ratio (24-29) of water hyacinth indicates that formation of organic matter consists of better humic fertilizer. The root extract of the plant was reported to aid crop reduction in a number of economic species such as *Corchorus capsu-laries*. This was confirmed by Oso (1988) by the production of liquid fertiliser from water hyacinth which enhanced the growth of okra and *Amaranthus* seedlings when applied as a top dressing.

(v) **Active Carbon:** This can be prepared from water hyacinth (Ahmed *et al*, 1983). The carbon when impregnated with $ZnCl_2$ is suitable for decolonisation purposes in pharmaceutical industries and for general application.

Although several authors have worked on the economic uses of water hyacinth, the prolific nature of reproduction and rapid propagation of the plant justifies its utilisation in the 21st century.

The increasing rate of urbanisation and industrialisation processes around the globe coupled with the resultant pollution problems call for an inexpensive means of pollution control of which water hyacinth could be effectively utilised for, in a developing nation such as Nigeria. Hence, the main thrust of this paper is to analyse the plant – water hyacinth for its potential as a mopping agent and

scavenger of heavy and toxic elements in industrial and domestic effluents.

EXPERIMENTAL

Eichhornia crassipes (Mart) plants were randomly sampled in Badagry Creeks in Lagos State and Igbokoda waterways in Ondo State for a period of two years at different seasons in the months of January, March, June, September and December. The plants were transported in jute bags and reached the laboratory within few hours of collection where they were further processed immediately.

One (1) kilogram of dried sample was ashed in a muffle furnace at 550C for five hours in a pre-weighed crucible. The weight difference gave the organic matter and the difference in weight between the ashed sample and the crucible gave the weight of ash.

Ashed samples were further digested with 2N HCL diluted to 100ml and used for mineral analysis on the Atomic Absorption Spectro-photometer (Perkin Elmer 306).

RESULTS AND DISCUSSION

The heavy metals and toxic element contents of *E. crassipes* expressed on dry matter basis were as shown in Table 1.

These values were found to vary slightly in the samples from Badagry water. One way analysis of variance showed that the values of Cu, Cr and Fe were significant at $P < 0.001$ while that of Pb was significant at $P < 0.05$.

The ash content was high, ranging from 12.04% in the leaf blade to 19.03% in the roots and 16.10% for petiole. This suggests that the plant is rich in minerals. The values are comparable with the 12 – 18.4% findings of Ghosh *et al* (1983). Rachet *et al* (1983) reported that water hyacinth plants are able to absorb heavy metals such as Cd, Hg, Ni. Also Becker *et al* (1984) reports confirmed that the plant has the capacity to accumulate heavy metals at no detriment to itself.

The results of heavy metals were in conformity with the report of McDonald (1975) that for every gramme of water hyacinth dry matter, heavy metals

Table 1 Heavy Metals in *Eichhornia crassipes* (mg/g dry wt)

Sample	Cd	Cu	Cr	Fe	Nr	Pb
Leaf-blades	1.16 ± 038	3.67 ± 1.53	1.09 ± 1.08	34.77 ± 3.99	2.69 ± 0.79	23.12 ± 4.74
Petioles	2.48 ± 1.37	2.87 ± 0.30	1.90 ± 2.27	139.98±5.09	2.36 ± 2.87	12.83 ± 8.91
Roots	1.81 ± 0.88	13.45 ± 3.37	17.53 ± 6.42	120.17±41.08	5.32 ± 2.07	43.00 ± 18.59
P	NS	0.001	0.001	0.001	NS	0.05

All figures are expressed as mean values of triplicate determinations with their standard deviation in parentheses P = Probability; NS = Not Significant

occurred in varying amounts as Cd (0.67 mg); Ni (0.06 mg); Pb (0.176 mg). These are metals that can have toxic effect on both aquatic organisms and their consumers especially man, due to bioaccumulation and biolomagnification.

CONCLUSION

Water hyacinth is in no doubt a menace in Nigeria waterways but the analytical investigation of the plant showed accumulation of heavy metals like Ph, Cr, Cu, Cd and Ni in both the leaf blade, petiole and root of the plant. This indicates that the plant is a scavenger of toxic elements and moping agent for these heavy metals which are present in both industrial and municipal effluents of the nation's aquatic environments.

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