



## DESALINATION BY AQUATIC WEEDS

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## INTRODUCTION

Coastal areas are generally faced with scarcity of fresh water. In states like Kerala, where population density along the coastal belt is very high, it would be really a blessing if fresh water could be made from the locally available saline water. Because of heavy rains and surface run-off, the degree of salinity of the water in shallow ponds and wells in coastal Kerala is only of the order of 3000-4000 mg/l. Water hyacinth grown in such open ponds can effectively remove the chloride concentration and render the water useful for most domestic purposes. The experimental results obtained from a batch reactor study in the environmental engineering laboratory of Engineering College, Trichur indicated that this method is feasible for reduction of salinity of such water sources.

## WATER HYACINTH

Water hyacinth is an aquatic weed which is considered to have originated from Tropical America and has now spread over 50 countries of the world. Botanically known as *Eichhornia crassipes*, this aquatic weed has been considered as a menace in water bodies. This weed has a fleshy vertical stem, a rhizome which floats just beneath the water surface and is protected by sheds of folded leaves. This weed reproduces largely by vegetative means and are interconnected by stolons. Its fine feathery roots are fibrous and branched. This weed, which floats in water, can double in 8-10 days in warm and nutrient rich waters. The daily increment factor at the period of maximum growth is reported to be 1.066-1.077 for plant number and 1.090-1.060 for wet weight (ref. 1). It contains 95% by weight of water.

## CAPACITY OF WATER HYACINTH IN REMOVAL OF ORGANICS AND INORGANICS

The ability of this weed to remove 80% of nitrogenous compounds and 40% of phosphorous compounds from sewage within 2 days has been reported by Wolverton (ref. 2). This aquatic plant has remarkable capacity to filter out and concentrate heavy metals such as gold, silver, cadmium, nickel mercury and chromium and other toxic materials. *Eichhornia crassipes* can effectively remove phenols and phenolic compounds from waters. In India, water hyacinth has been utilised for the treatment of industrial waste waters and toxic effluents (ref. 3). Raman (ref. 4) stated that these aquatic weeds are capable of removing upto 95% of BOD from waste waters. Harvested water hyacinth can be used as a manure, animal feed, and as a raw material for biogas generation and plastics manufacture. In this paper the capacity of water hyacinth for chloride and ammonia N removal is reported.

## MATERIALS AND METHODS

*Eichhornia crassipes* was grown in a cement plastered square tank of dimensions 3.0 m x 3.0 m x 0.9 m, with arrangements for taking samples at various depths. This tank shown in figure 1 is located in the open courtyard of civil engineering laboratory. The liquid depth was maintained at 0.75 m throughout the study. The tank was filled with 0.75 m depth of tap water with calculated quantities of ammonium chloride, potassium dihydrogen phosphate and sodium chloride. Initial concentrations of chloride and ammonia N were determined soon after addition of these chemicals. At the end of 3-7 days, samples were collected and analysed for the chloride and ammonia N concentrations as per Standard Methods (ref. 5). The experiments were carried out for a period of 20 days.

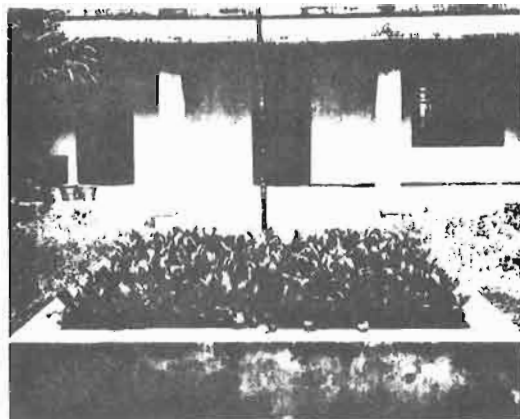


Figure 1. Experimental Tank

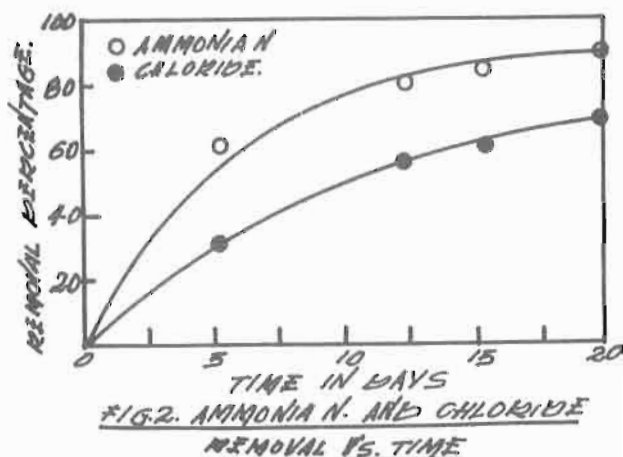
## RESULTS AND DISCUSSION

The results obtained from a batch reactor study are presented in table 1.

Table 1. Removal Percentages of Chloride and Ammonia N.

Time in days	Chloride		Ammonia N	
	Concen- tration mg/l	Remo- val %	Concen- tration mg/l	Remo- val %
0	3000	0.0	32.48	0.0
5	2010	33.0	11.76	63.79
12	1200	60.0	5.60	82.86
15	1078	64.1	3.92	87.93
20	693	69.9	2.20	93.40

The chloride and ammonia N removal pattern can be seen by referring to table 1 and figure 2.



The percentage rate of ammonia N removal was rapid during the first 5 days; thereafter the rate declined.

But the chloride removal rate was steadily increasing with time upto 12 days and thereafter the rate was declining. The total removal of chloride at the end of 20 days was found to be 69.9%. The weed pond removed 2317 mg/l of chloride from water with an initial chloride concentration of 3000 mg/l. As soon as chloride and ammonia N feed was given, the weed flourished with fresh shoots and attained a dark green colour. However, at the end of the experimental period, the weeds became slightly pale. This might be due to depletion of nutrient supply as indicated by low ammonia N levels in the reactor. The root system was as long as 65 cm and very thick. It might be due to the uptake of chloride ions and ammonia N through the roots, rhizome, floating leaves and stem that the removal of the above ions and nutrient took place to such a great extent. Such phenomena have been reported in cases of water plants by Luttege *et al* (ref. 6) and for mung beans by Bowling (ref. 7).

## DESALINATION BY WATER HYACINTH

The capacity of water hyacinth to remove chlorides is of great significance in using them as a means for desalination. *Eichhornia crassipes* is reported to be capable of reducing total coliform bacteria from septic tank effluent from 170,000 to 10 per 100 ml in 24 hours (ref. 8). The weed has a high efficiency in the removal of BOD and suspended solids.

From the experimental results discussed in this paper, it is clear that these aquatic weeds can reduce chloride concentration from saline waters. The decaying parts of the weeds may contribute to BOD; but this BOD may get removed by the metabolic uptake in these plants. As such, slightly saline waters can be purified and desalinated by these weed ponds. If two ponds are put in serial operation, the desalination may be more effective. This type of saline water renovation does not require much of energy input. Thus this method has to be viewed as a vital one in the present context of energy and fresh water crisis. A pilot plant study is necessary to evolve detailed designs of such a process.

## CONCLUSION

Eichhornia crassipes are capable of removing chlorides to the extent of 69.9% from saline waters containing 3000 mg/l of chloride in 20 days. Desalination and purification of slightly saline waters can be accomplished effectively by water hyacinth ponds. As such, hyacinth ponds provide a promising low cost method for renovation of saline waters for various uses.

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