

ABSTRACT

Utilization of Floating Aquatic Plants for Wastewater Treatment in Jamaica

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Aquatic plants have long been considered a menace in many countries. Floating aquatic plants such as *Eichhornia crassipes* (Mart.) Solms have been the target for many expensive control measures. Recently however, much research has been directed towards their use for wastewater treatment. Several experiments were conducted in the present study to determine different properties of selected floating aquatic plants and the possibility of their use in wastewater treatment, particularly sewage, under Jamaican conditions.

Growth characteristics and nutrient removal capacity by *Lemna polyrhiza*, *Salvinia* sp., *Pistia stratiotes* L. and *Eichhornia crassipes* (Mart.) Solms, were first determined. The plants were grown in small tanks containing standard culture solution for 120 h. $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$ and $\text{PO}_4\text{-P}$ were successfully removed from solution and tissue N and P generally increased. The percentage increase in plant weight ranged from 11% (*Eichhornia*) to 151% (*Lemna*) at 120 h.

The response of *Lemna* and *Pistia* to a range of variations of the standard culture solution was examined. The plants were grown for 72 h in small tanks containing nutrient solutions of different concentrations. *Lemna* removed more nitrogen and produced more biomass at the lower concentrations. *Pistia* however removed more nitrogen and produced more biomass at the intermediate concentrations. Phosphorus was removed at the higher nutrient solution concentrations by both plants. Differences in growth and nutrient removal by these plants means they could be suitable for use in polyculture systems.

Growth and nutrient removal capacities of all four plants from small tanks containing secondary treated effluent was next examined. The plants were grown in the effluent for 120 h. Average removal of $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$ and $\text{PO}_4\text{-P}$ was 55%, 39% and 15% respectively. Tissue N and P increased by an average of 42% and 59% respectively. The plants increased in weight by an average of 25%.

Eichhornia was used to determine the nutrient removal capacity on a pilot-scale basis. The experiments were conducted in a series of six tanks each of volume = 5.4×10^3 l containing *Eichhornia*, with secondary treated effluent supplied at a rate of $16,200 \text{ l day}^{-1}$ for seven days.

Total N decreased daily between tanks one and six by an average of 30%. Total P decreased on some days but increased on others between tanks one and six. The average percentage reduction in total N and P in a tank over the seven day period was 84% and 15% respectively. Tissue N increased by 2.9% and P by 6.9%.

The present results showed that the aquatic plants effectively removed nutrients from solution. This removal of nutrients was reflected in the plant's tissue. Removal was dependent on the N:P concentration ratio of both the nutrient medium and the plant tissue.

The design of the aquatic treatment system in the present study could treat sewage from a community of an average population of 2,500 people. The nutrient levels of the water produced were suitable for irrigation purposes.