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Short Term Treatment of Shrimp Aquaculture Wastewater Using Water Hyacinth (*Eichhornia crassipes*)

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Abstract: Among the environmental concerns of shrimp aquaculture is pollution from pond effluent. Water hyacinth was found to be effective in treating different types of wastewater. Therefore, in this study the potential of short term treatment of pond effluent was investigated. Wastewater from newly harvested shrimp pond was placed in fiberglass tanks outdoor where water surface was fully-cover (F), half-cover (H) and not covered (control) (C) with water hyacinth for 76 hours. Results show that percent reductions were in decreasing order of F>H>C in all the parameters studied. Ammonia nitrogen in F decreased from 1.8 mg/L to 0.2 mg/L in 46 hours whereas in H and C, their concentrations were above 0.6 mg/L. For F treatment, percentage reductions ranged from 52.5 to 100% and were in the order of NO_3-N>NO_2-N>TP>TAN>TN>TSS>RP>BOD_5>COD. In H, reduction ranged between 45.4 to 95.2% and in C they ranged from -18.5% to 74.9%. First order decay coefficient for all the parameters were the highest in F followed by H and C treatments. This study showed that even though the duration of the treatment was short, suspended solids, oxygen demand, nitrogen and phosphorus reductions were significantly higher in the water hyacinth treatments compared to treatment without water hyacinth.

Key words: Water hyacinth · Shrimp effluent · Wastewater treatment · Aquatic macrophytes · *Penaeus monodon*

INTRODUCTION

Shrimp aquaculture is an important industry as capture shrimp is not able to meet the growing global demand of shrimp products and it brings high economic returns [1]. Shrimp aquaculture is mostly concentrated in Asia and among the concerns is water pollution from intensive shrimp aquaculture [2]. Intensive shrimp farm wastewater was reported to be high in total suspended solids and high in nutrients such as nitrogen and phosphorus [3, 4] due to the low assimilation of nitrogen and phosphorus by the shrimp. Nutrient budget studies showed that shrimp could only assimilate 23-31% nitrogen and 10-13% phosphorus of the total input [5]. Thus, the remaining nitrogen and phosphorus are discharged during regular water exchange or incorporated in the pond sediment which is washed out after shrimp harvesting. An economical way to treat the wastewater is to discharge it into sedimentation ponds. In Malaysia, similar management practice is in place whereby shrimp operators are required to retain the wastewater in sedimentation ponds for 72 hours prior to release into the rivers in order to protect the surrounding environment. However, studies indicate that sedimentation ponds were effective in reducing discharges of suspended particulates but less effective in reducing nutrient concentrations [6].

Treating wastewater using aquatic macrophytes not only protects the receiving water from eutrophication and the negative impacts on aquatic organisms but also allows nutrients to be recycled. Recycling of nutrients is urgent because nutrients such as phosphorus are a non-renewable resource derived from phosphate rock and current global reserve may be depleted in 50-100 years [7]. Different aquatic plants systems for treatment of shrimp farm wastewater have been reported. Submerged aquatic plants, *Elodea densa*, were reported to reduce the peak ammonia and nitrite concentrations of recirculating *Macrobrachium rosenbergii* culture systems [8]. Experimental scale model constructed wetland with *Acrostchum aureum*, a mangrove fern, in gravel was

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