

PHYTOREMEDIATION OF AMMONIACAL NITROGEN IN WASTEWATER USING *Eichhornia crassipes*: TOLERANCE LIMIT AND pH STUDY

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Accepted 23 January 2018, Published online 31 March 2018

ABSTRACT

High ammoniacal nitrogen (AN) in industrial effluent must be treated before final discharge to prevent eutrophication phenomenon. Phytoremediation is recommended to be a better solution to treat wastewater with high AN content due to its cost-effective, environmental friendly and sustainable characteristics. Water hyacinth (*Eichhornia crassipes*) has been widely applied in phytoremediation technology to remove various types of pollutants. In this study, AN synthetic wastewater with varied AN concentrations of 10-200 mg/L was prepared to conduct tolerance limit test of water hyacinth for 10 days. The effect of pH on the physico-chemical parameters of AN synthetic wastewater and water hyacinth biomass growth was also investigated. Under sunlight exposure, it was found that water hyacinth was able to survive up to 150 mg/L of AN concentration for a duration of 10 days. The results showed that pH factor posed a significant impact on biochemical oxygen demand (BOD₅) and biomass growth of water hyacinth whereas less significant impact was exhibited on chemical oxygen demand (COD) and total suspended solids (TSS). Overall, water hyacinth has been shown to be a feasible macrophyte for phytoremediation of AN in wastewater.

Key words: Phytoremediation, Water hyacinth, Ammoniacal nitrogen, Macrophyte

INTRODUCTION

In Malaysia, industrial effluent containing high level of ammoniacal nitrogen (AN) must be treated to achieve the concentration below 20 mg/L before discharged into waterbodies, as imposed by the Environmental Quality (Industrial Effluent) Regulations 2009. Instead of using conventional physico-chemical and biological treatment methods, phytoremediation technology is recognized as a better solution due to its cost effective, sustainable and environmental friendly characteristics as well as the efficiency in removing various pollutants in wastewater (Lu *et al.*, 2013; Paz-Alberto & Sigua, 2013; Rezanía *et al.*, 2015). Phytoremediation technology is a treatment process by making use of plant (phyto) to clean up (remediate) polluted soil, sediment, surface water and groundwater environments (Fox *et al.*, 2008). Water hyacinth (*Eichhornia crassipes*) has been considered as the

suitable candidate for phytoremediation to remove pollutants present in wastewater due to its characteristics of rapid proliferation, adaptation to a wide range of environmental condition and a large nutrient uptake capacity (Fox *et al.*, 2008; Lu *et al.*, 2008; Wang *et al.*, 2011; Hu *et al.*, 2012; Rezanía *et al.*, 2015). From the literature, several studies had reported the utilization of water hyacinth to treat wastewater which contained AN concentration ranging from 4.7 mg/L to 130 mg/L (Sooknah & Wilkie, 2004; Wang *et al.*, 2011; Hu *et al.*, 2012; Wang *et al.*, 2013; Anandha & Kalpana, 2015; Fazal *et al.*, 2015; Valipour *et al.*, 2015; Mayo & Hanai, 2014; Rezanía *et al.*, 2016). However, the AN tolerance limit of water hyacinth remains unknown. Thus, this study aims to investigate the feasibility of using water hyacinth for phytoremediation of AN in wastewater through determination of the tolerance capability of this macrophyte at varied AN concentrations, and to evaluate the effect of pH on the physico-chemical parameters of AN synthetic

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