

ABSTRACT

Heavy metals represent a serious form of pollution as they do not easily degrade and have a tendency to bioaccumulate. Malaysian waters suffered with 30 to 100 times more pathogens, heavy metals and poisons from industry and agriculture above than government standards permit. A presence of excessive nutrients input to a water bodies resulting increased biomass, nuisance algal blooms, species fatality due to low or depleted oxygen caused impairment of freshwater and lake aging. A broad number of physico-chemical parameters and biological characteristics render the degree of quality of water resources. This research aimed to study the effectiveness and ability of selected aquatic plants as ecological indicators for monitoring and assessing aquatic environmental conditions. To achieve this ten different locations were selected as site studies which located in the district of Selangor and Kuala Lumpur. All of these sites are urban lakes which have been identified and observed based on the lake surrounding and abundance of aquatic plant life. These sites were chosen based on its location, human and physical characteristics as well as for their tolerance to eutrophic and heavy metal contaminants through various physico-chemical parameters and water quality analysis. In order to assess type of aquatic plant species that can tolerate low, medium and high concentrations of contaminants an in vivo model system with a fully controlled environment in laboratory scale was established. In this model system, metals accumulation from different concentration of heavy metals was investigated using *Riccia fluitans* to assess the effectiveness of selected aquatic species in remediating urban lake contaminants. Analysis of nutrient contaminants from ten different urban lakes and a total of nine different aquatic plant species which are submergent (*Hydrilla verticillata* and *Cabomba caroliniana*), emergent (*Eleocharis ochrostachys* and *Ipomoea aquatic*) and free-floating (*Nymphaea lotus*, *Nymphaea pubescens* and *Nelumbo nucifera*) and Algae, sp. demonstrated highly significant differences ($P < 0.0001$) between aquatic plant species widespread, locations and the nutrients content. Results indicated that *E. ochrostachys* was a good phytoindicator for NO_3^- excess, *H. verticillata* and *I. aquatica* were efficient phytoindicator for PO_4^{3-} , Algae species for Mn, *N. pubescens* and *C. caroliniana* for Fe whereas *H. verticillata* for Zn. Interestingly all measured lakes were found at the stage of hypereutrophic or exceeded the normal level of NWQS for Malaysian rivers which is 0.2 mg/L (Class II and III). Analysis of heavy metals sequestration rate by *R. fluitans* at three different concentrations (1.0, 2.0 and 5.0 mg l⁻¹) and at four different periods of time (week 1 to week 4) revealed that this species was a good agent to sequester Cu>Mn>Zn>Fe>Pb at 60.4%, 20.3%, 5.4%, 1.3% and 1.3%, respectively. The analysis affirmed the accumulation of different metals within the plant and an equally lessen of metals in the water. As a conclusion, *Riccia fluitans* is proven to be a potential biosequester agent for polluted aquatic environment. As a whole, the abundance or loss of certain key species can be used as indicator for eutrophication state and level for urban lakes management and maintenance as well as confirmed the aquatic macrophytes is a promising candidate as a phytoremediation agent.