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Enhancement of Water Quality in Kandy Lake with Duckweed: An Assessment of Efficacy

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Abstract

Kandy Lake is one of the main tourist destinations in Sri Lanka and recognized as world heritage by UNESCO. The lake's water quality has deteriorated to eutrophic and hyper-eutrophic levels, due to adequate regulations and poor water quality management. Therefore, the present study intends to evaluate the potentiality of duckweed species for phytoremediation of water in Kandy Lake, Sri Lanka. This study examined the effectiveness of two common duckweed species, *Spirodela polyrhiza* and *Lemna perpusilla*. The experiment evaluated the impact on water quality over twenty-eight days with assessments at weekly intervals. The results showed that there was a significant difference in total dissolved solid (TDS), salinity, electrical conductivity (EC), dissolved oxygen (DO), and the concentrations of nitrate, and sulphate with time ($P < 0.05$). *L. perpusilla* achieved a 100% reduction of nitrate by day 7th day of the experiment, while *S. polyrhiza* reached a 100% reduction by day 14 of the experiment. DO level increased up to 7.8 mg/L in water treatment with *S. polyrhiza* compared to an increase to 6.6 mg/L in the *L. perpusilla* treatment, from a control level of 0.73 mg/L ($P < 0.05$). TDS level was reduced from 310.0 ± 3.6 mg/L to 203.6 ± 1.5 mg/L by *S. polyrhiza* indicating a 34.4% reduction rate and the results show 34.13% TDS reduction in *L. perpusilla*. Among the two plant species *S. polyrhiza* demonstrated advantages in reducing salinity from the initial 293.96 ± 5.1 mg/L to 197.6 ± 4.9 mg/L and that indicates a 32.78% reduction of salinity from the initial concentration. *L. perpusilla* reduced salinity to 211.3 ± 4.9 mg/L from the initial concentration which indicates a 28.13% reduction of salinity. It was also found that both plant species effectively contribute to the rise of DO levels up to accepted standards of drinking water. *L. perpusilla* achieved the highest EC reduction rate at 38.24%, while *S. polyrhiza* showed a reduction rate of 33.1%. The pH value fluctuated in the 7.6-8.6 range in all treatments. Both Duckweed species showed effective phytoremediation capabilities, with each species excelling in specific areas *S. polyrhiza* have a high capacity to maintain TDS, salinity, and DO levels in water. Salinity, nitrate, and sulfate remediation was higher in *L. perpusilla* spp. Both duckweed species have escalated nitrate removal by supporting microbial activity under available oxygen. These findings suggest that both duckweed species can serve as eco-friendly, cost-effective solutions for phytoremediation, helping to mitigate pollution in freshwater ecosystems.

Keywords: Dissolved Oxygen, Nitrate, Phytoremediation, Total Dissolved Solids, Water pollutants