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Phytoremediation efficiencies of *Spirodela polyrhiza* and *Brassica oleracea* in removing nutrients from treated sewage effluent

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ABSTRACT

The study investigates the capacity of phytoremediation as a post-treatment step for the nutrient-rich-treated sewage effluent from Saga City sewage treatment plant, Saga, Japan. Phytoremediation in the context of this study is the removal of nutrients such as ammoniacal nitrogen, nitrate nitrogen and phosphorus from the nutrient-rich-treated sewage effluent by plants. In this study, *Spirodela polyrhiza* (*S. polyrhiza*) and *Brassica oleracea* (*B. oleracea*) were used to phytoremediate the treated sewage effluent collected from the Saga City Sewage Treatment Plant under laboratory scale. Plants were grown in polypropylene planter box supplied with 8,000 mL treated sewage effluent under indoor environment and full water retention throughout the experimental studies. The removal efficiency and daily absorption of nutrients by phytoremediation plants were determined. It was found that the most optimal removal efficiency and average daily nutrient removal rate by *S. polyrhiza* throughout the experiment were 92.42% ± 1.29% or 15.4 mg/L/d for ammoniacal nitrogen achieved in day 1, 78.69% ± 10.31% or 2.68 mg/L/d for nitrate-nitrogen achieved in day 4, and 93.45% ± 3.26% or 0.51 mg/L/d for phosphorus in day 3 of an experiment. On the other hand, the removal efficiency and average daily nutrient removal rate by *B. oleracea* throughout the experiment gave a total of 8 d where 76.07% ± 10.38% or 1.68 mg/L/d for ammoniacal nitrogen, 78.38% ± 0.40% or 1.19 mg/L/d for nitrate-nitrogen and 67.40% ± 10.91% or 0.10 mg/L/d for phosphorus. The overall findings demonstrated that phytoremediation by *S. polyrhiza* was far more effective in removing nutrients from the nutrient-rich-treated sewage effluent compared to *B. oleracea*. The significance of the study includes reducing the possibility of eutrophication outbreak caused by the disposal of treated sewage effluent, advocating less dependency on global demand for non-renewable phosphorus resources in the agriculture sector, and solving food demand due to the increasing world population.

Keywords: Phytoremediation; Treated sewage; Effluent; *Spirodela polyrhiza*; *Brassica oleracea*

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