THESIS

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AGRICULTURAL WATER MANAGEMENT ENGINEERING

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ABSTRACT OF THESIS

NUTRIENT REMOVAL BY MICROALGAE FROM PRE-TREATED MUNICIPAL WASTEWATER

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Conventional wastewater treatment methods are constrained by high energy consumption, operation costs, and poor nutrient recovery. Phosphorus is an essential element for all living organisms after nitrogen, but it is a finite and a non-renewable resource, largely derived from phosphate rock. With P reserves dwindling and population growth increasing, it is imperative to find sustainable ways to recover and recycle phosphorus. Microalgae-based wastewater treatment provides a promising solution to recover essential nutrients while mitigating eutrophication caused by excessive nutrient levels in surface waters. This study evaluates the efficiency of *Chlorella vulgaris* in utilizing nitrogen and phosphorus nutrients for growth and biomass production in municipal wastewater. The algae was cultured in pre-treated municipal wastewater for 7 days using different dosages. The effectiveness of chemical flocculants in microalgal biomass harvesting were also investigated. Sodium hydroxide (NaOH), potassium hydroxide (KOH), calcium hydroxide ($Ca(OH_2)$, ferrous sulphate ($FeSO_4$), potassium sulphate (K_2SO_4) and calcium carbonate ($CaCO_3$) were employed in different dosages to harvest microalgal biomass by sedimentation over time. Results showed that *C. vulgaris* grew without any inhibitory effect in the wastewater samples and efficiently removed N and P at 88% and 95% respectively. This growth was also detected by an observed increase in pH, and the nutrient removal was proven by a measured decrease in electrical conductivity values. Surprisingly, lower dosages of *Chlorella vulgaris* displayed a higher increase in biomass density compared to higher dosages despite both ending at similar biomass density levels. Our investigation on algae flocculation indicated that calcium hydroxide was the most effective flocculant after both 5 and 60 minutes. However, all low dosages of the flocculants in our modelling experiments were found to be insufficient to improve the normal settling rate of algal biomass. The application of $Ca(OH)_2$ as a flocculant appears to be a promising option due to its safe use and relatively low cost.