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Effect of combining adsorption-stripping treatment with acidification on the growth of *Chlorella vulgaris* and nutrient removal from swine wastewater

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Abstract: After swine wastewater (SW) was treated with adsorption-stripping stage, the concentration of NH_4^+ -N and Total phosphorus (TP) in SW significantly decreased from 598.04, 42.95 to 338.02, 8.36 mg L⁻¹, respectively. The concentration of heavy metals, especially Zn^{2+} (96.78%), decreased by the ion exchange of artificial zeolite (AZ). The acidification of SW could significantly improve the nutrient utilization efficiency and promote the growth rate of *C. vulgaris* due to the hydrolysis of macromolecular substances into smaller molecules usable for *algae*. By combining adsorption (Part I), stripping (Part II) and cultivation (Part III), the highest removal rates of NH_4^+ -N, TP, chemical oxygen demand (COD) and total organic carbon (TOC) from SW were 80.50, 96.90, 72.91, and 84.17%, respectively, and the OD₆₈₀ value was 1.129 (1.48 times of control) at pH 6.0. The combined system (Part I—III) can significantly enhance the removal efficiency of nutrient and biomass production by acidification.

Keywords: Swine wastewater (SW); Adsorption-stripping; *Chlorella vulgaris*; Nutrient removal; Acidification

1. Introduction

Swine wastewater (SW) production has increased exponentially in many countries due to the immense economic development and rapid population growth (Kuruti et al., 2017). However, a large amount of SW can promote global warming because of the emission of greenhouse gases, eutrophication caused by the runoff of phosphorus and nitrogen compounds into lakes, and soil acidification owing to the release of gaseous ammonia (Limoli et al., 2016). In many countries, nutrients in SW need to be removed significantly to meet the surface water quality before being discharged by wastewater treatment plants (WWTP). Although SW has been used to produce biogas by anaerobic digestion, there are still rich in nitrogen, phosphorus, metal heavy, and other

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