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# Application of *Chlorella* sp. to the removal of nitrogen and phosphorus in pig wastewater and carbon dioxide in biogas [1]

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## Abstract

After the three-stage treatment of pig wastewater, concentrations of nitrogen (N) and phosphorus (P) of the water were still high. The biogas produced in the anaerobic treatment stage contained a high proportion of carbon dioxide ($CO_2$), which could provide algae as a carbon source. Therefore, the aim of this study was to explore the effects of application of the discharged pig wastewater from the three-stage treatment system and the biogas produced from the anaerobic stage to cultivate *Chlorella* sp., with regards to the removal of N and P in the wastewater and the consumption of $CO_2$ in the biogas. The reuse of resources is expected to reduce the negative impacts of the discharged wastewater on the water body and of the biogas on global warming. A sample of treated pig wastewater with N and P concentrations of 324 mg/L and 84 mg/L, respectively, was used as the culture medium for *Chlorella* sp. Three different carbon dioxide supply methods including static state (group A), forced air bubbling (group B) and forced biogas bubbling (group C) were used on the cultivation of *Chlorella* sp. After two weeks of cultivation, the concentration of N (200 mg/L) and P (49 mg/L) in the culture medium of group C was significantly lower ($P < 0.05$) than those of groups A and B. The removal efficacies of N and P of group C were 38.4% and 41.4%, respectively. The biomass production of algae of group C was higher ($P < 0.05$) than those of groups A and B, and the carbon dioxide consumption of *Chlorella* sp. was estimated to be 4.84 L/g. Besides. The contents of crude protein (CP) and P of algae produced from all the three groups were between 41 to 64% and 2.18 to 2.86% on a dry matter basis, respectively. In summary, the use of the three-stage treated pig wastewater and biogas to cultivate *Chlorella* sp. can effectively promote its growth and reduce the N and P contents of wastewater and the $CO_2$ in the biogas. The CP and P content of *Chlorella* sp. are similar to those of soybean meal and fish meal, which could likely be used as one of feedstuff ingredients. However, it is necessary to refine the algae harvesting and the cell wall breaking technology, in practice, and there were still some algae suspended in the upper layer of harvested culture liquid after the centrifugation operation, which must be properly treated.

Key words: *Chlorella* sp., Pig wastewater, Nitrogen and phosphate removal.

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