

ABSTRACT

Influencing factors for simultaneous removal of organics and nutrients from wastewater using A²O reactor

by

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Macau, a Special Administrative Region of China, has a limited water resource due to its geographical setting and physical environment. Currently, a majority of water for Macau comes from Xijiang of the Pearl River in Guangdong. According to the environmental status reports published by the Macau Environment Council in recent years, Macau water quality has continued to worsen and coastal waters with high eutrophic index are still recorded. There are four major wastewater treatment plants in Macau, mainly operated with the conventional activated sludge system and so called UNITANK system. These wastewater treatment methods are effective for the organics and suspended solids removal rather than nutrients removal. Thus, more advanced technologies are required in order to remove both organics and nutrients at the same time and to provide a better effluent quality for reusing in future. In this research, a lab-scale Anaerobic/Anoxic/Oxic (A²O) reactor was operated to investigate the major influencing factors for simultaneous removal of organics and nutrients from Macau domestic wastewater. Besides, the further reuse possibility of Macau wastewater, using A²O reactor coupled with membrane filter, is discussed. The seed activated sludge was obtained from Taipa and Coloane wastewater treatment plants (WWTPs). During adaptation period of the activated sludge in A²O reactor, the operation parameters like influent phosphorus concentration, external carbon source and external recycle rate were optimized. The principal factors affecting organics and nutrients removal, including COD/TN ratio and COD and chloride co-effect were investigated using synthetic wastewater with the content similar to the Taipa

wastewater. Under different conditions, the corresponding microorganisms were incubated and observed using spread plate counting method. Compared to the UNITANK system currently being used at the Taipa WWTP, the A²O reactor was shown with better removal efficiencies for COD, TN, and TP at 97%, 80%, and 81%, respectively. In order to assess the potential for future wastewater reuse application, effluent from A²O reactor was further treated by using membrane filter. The final effluent could meet all the quality goals for various regional reuse purposes. Overall, the effluent quality of optimized A²O process met the set standard of discharge limits for domestic wastewater. Further research on A²O process coupled with membrane filtration technologies is warranted. Following the environmentally sound and sustainable development, the thriving economy in Macau would be much enhanced through the application of such technologies as the wastewater treatment and reuse technology developed in this research.