Preface

Special Issue on Future Challenges in Technology for Water and Wastewater

Water environment faces several challenges in this century, which include lack of clean and fresh water due to severe variations of water quality and quantity caused partly by climate change. Drought and flash flooding are not rare nowadays. The drought makes difficulties in acquiring clean water to take for water supply. For instance, high temperature in rivers and streams during summer drought extremely aggravates water quality. In addition, great removal of pollutants from wastewater is necessary to maintain acceptable levels of water quality in receiving aquatic ecosystem. The flash flooding also requires efficient and economic ways of operating water and wastewater systems.

Tremendous efforts have been made during the last two decades on development of efficient wastewater treatment processes to reduce phosphorous and nitrate concentrations in effluents, which can alleviate possibility of eutrophication and severe hazardous algal blooming in water. Membrane technology has been substantially applied in water and wastewater treatment processes to obtain high quality of product water. Microfiltration and ultrafiltration are used extensively in water treatment processes for removal of microbial particles and in wastewater treatment for retaining high concentrations of activated sludge in bioreactor processes. Reverse osmosis has been also applied as a tertiary process to treat wastewater effluent in addition to desalination of sea or brackish water. Much research has been conducted to obtain enhanced performance in membrane process by efficient operating technologies.

The special issue on "Future Challenges in Technology for Water and Wastewater" aims to reflect improvements in technologies in treating water and wastewater to overcome challenges due to the substantial variations of water quality from climate changes and to share the latest development in membrane technology to treat phosphorus and nitrate for meeting the requirement of high quality of wastewater effluents. The scopes of the special issue also include to address the novel membrane technologies such as membrane distillation and electrodialysis, and risk-based life cycle cost analysis for a water purification system.

This special issue contains a total of 8 peer-reviewed papers. Two papers discuss technologies related to advances in evaluating greenhouse gases in wastewater treatment processes and nutrient removals. The paper "Greenhouse gases emission from aerobic methanotrophic denitrification in sequencing batch reactor" by Kwanhyoung Lee, Oh Kyung Choi, and Jae Woo Lee investigates effects of several operational parameters on characteristics of emission of three greenhouse gases, i.e., CH_4, CO_2 and N_2O in a sequencing batch reactor for denitrification. The importance of minimizing CH_4 emission through microporous membrane diffuser to enhance mass transfer of CH_4 is discussed in the paper. In the paper "Adsorption kinetics and isotherms of phosphate and its removal from wastewater using mesoporous titanium oxide" by Kwanyong Lee, Warangkana Jutidamrongphan, Seokwon Lee, and Ki Young Park, mesoporous TiO_2 to remove phosphorous from wastewater and to recover adsorbed phosphorous for further use has been examined. The study shows interesting adsorption capacity results, which reveal potential uses of mesoporous

TiO_2 as an alternative phosphate adsorbent. Direct membrane distillation as a novel membrane technology has been applied to livestock wastewater in the paper "Evaluation of the efficiency of cleaning method in direct contact membrane distillation of digested livestock wastewater' by Sewoon Kim, Ki Young Park, and Jinwoo Cho. Various physical and chemical cleaning methods are evaluated in membrane distillation. Electrodialysis for removal of nitrate is discussed in the paper "Removal of nitrate by electrodialysis: Effect of operation parameters". Proper values of operating parameters increase dramatically removal efficiencies in electrodialysis. The paper "Carbonate scale reduction in reverse osmosis membrane by CO_2 in wastewater reclamation" addresses use of carbon dioxide purging to improve life span of reverse osmosis through inhibiting calcium carbonate scaling, which acts as a detrimental foulant to the membrane. Pretreatment prior to the main membrane process is enormously critical to maintain effective membrane operation, which is a subject of the paper "Effect of coagulation conditions on ultrafiltration for wastewater effluent" by Sung Kyu Maeng, Thomas C. Timmes and Hyun-Chul Kim. The study "Effects of sodium hydroxide cleaning on polyvinylidene fluoride fouled with humic water" also reveals that effective cleaning depending on membrane materials substantially affects fouling in membrane systems. The paper "Economical selection of optimum pressurized hollow fiber membrane modules in water purification system through risk-based life cycle cost" further discusses method to evaluate optimal membrane modules in the economical side of operation and maintenance in practical field.

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