International Conference on **Food Safety & Regulatory**
&
3rd International Conference on
**Water Microbiology, Water Sustainability and Reuse Technologies**
December 03-04, 2018 | Chicago, USA

# Biodegradation kinetics of phenol and 2-chlorophenol by mixed cultures in a fixed biofilm process

**Yen-Hui Lin** and **Chia-Hung Wu**
Central Taiwan University of Science and Technology, China

**Statement of the Problem:** Phenols and chlorophenols produced from chemical industries such as petroleum refineries, pharmaceuticals, pesticide industry and plastic manufacture have resulted in a serious ecological problem as environmental pollutants. Various treatment methods such as activated carbon adsorption, chemical oxidation, and aerobic/anaerobic biodegradation have been extensively applied to treat chlorophenolic compounds from wastewater. Compared with physicochemical methods, biodegradation has been widely used to deal with chlorophenolic compounds in wastewater because of low treatment cost and low possibility of byproduct formation. A wide range of study is available on biodegradation kinetics of single phenol or 2-chlorophenol (2-CP) with pure or mixed cultures of microorganisms. However, the study of biodegradation kinetics of phenol and 2-chlorophenol simultaneously by mixed culture is still scarce. In this study, the fixed biofilm reactor was conducted to verify the kinetic model of simultaneous biodegradation of phenol and 2-CP. The modeling and experimental results are compared for the effluent concentration of phenol and 2-CP in the fixed biofilm process.

**Methodology & Theoretical Orientation:** Three batch biodegradation experiments for phenol, 2-CP, and phenol plus 2-CP were performed in 250ml batch reactors with acclimated activated sludge to determine biokinetic parameters. The effective working volume of biofilm reactor was 1.6L, which yielded a hydraulic retention time (HRT) of 6h. The reactor was maintained at 30±0.2°C through a water jacket using a circulating water bath.

**Findings:** Experimental results for a mixture of phenol and 2-CP in batch experiments show that the phenol was completely removed within 4.2 days, however, the percentage of 2-CP removal was 55-79% at this stage. Initial phenol and 2-CP concentrations were 25.2 and 19.3mgL-1 with corresponding to the removal efficiencies of 98% for phenol and 89% for 2-CP while the packed-bed fixed biofilm reactor reached a steady-state condition.

**Conclusion & Significance:** The approaches of model and experiments presented in this study could be used to design a pilot-scale or full-scale fixed biofilm process for the biodegradation of phenolic and chlorophenolic wastewater from the discharges of various industries

## Biography

Yen-Hui Lin received his Master in Environmental Engineering at Cheng Kung University in Taiwan in 1987 and PhD in Environmental Engineering program at the Department of Civil Engineering and Mechanics from the University of Wisconsin-Milwaukee in the USA in 1998. From 1998 to 2004, he was appointed as a Research Fellow at Development Center of Biotechnology in Taiwan. He is currently working as Professor at the Department of Safety, Health, and Environmental Engineering at Central Taiwan University of Science and Technology in Taiwan. His primary study emphasized azo-dye decolorization in a biological activated carbon process and chromium(VI) bioreduction by *E. coli* 33456 on chitosan beads. Current funded research projects include removal of textile wastewater by using fly ash-chitosan composite supporting media in a fluidized-bed bioreactor and the removal of organic carbon and ammonium-nitrogen in leachate using fly ash-waste sludge-clay as a composite supporting medium in an oxic/anoxic biofilm reactor.

yhlin1@ctust.edu.tw

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