2011-12 TWRI Mills Scholarship Program

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4. **Description of Proposed Research**:

Needs for Research

Approximately 58 % of 139 U.S. streams and rivers, including those in Texas, were contaminated with triclosan, according to a recent USGS study. Triclosan (5-chloro-2-(2,4-dichlorophenoxy)-phenol) is an antimicrobial agent that has been incorporated into many personal care products. Triclosan is also an endocrine disrupting compound that can interfere normal function of endocrine systems of humans and animals. Triclosan has become a concerned emerging contaminant, because trace levels of triclosan can promote the development of antibiotic-resistant microorganisms that would pose a sever threat to public health. Under some environmental conditions, triclosan can be transformed into more toxic chemicals, like chlorodixins, chloroform, p-hydroquinone.

Wastewater effluent is one major source for the occurrence of triclosan in aquatic environment. Adverse effects to ecosystem and public health due to triclosan contamination might be more severe in watersheds in TX. For example, Trinity Rivers, flowing from Dallas/Ft Worth to Houston, receive effluent up to 90% of its flow capacity during summer time and the downstream of the river water is used as drinking water source for Houston Metropolitan area. In North-Central Texas area, triclosan at low levels (40 – 200 ng/L) was detected in Pecan Creek receiving the effluent from the city of Denton wastewater treatment plant (WWTP). Similar study also reported contamination of triclosan (785 ng/L) in Cibolo Creek in South Central Texas.

Despite trichlosan is an antimicrobial agent, biodegradation of triclosan in wastewater and river water has been reported. Accordingly, biodegradation plays an important role in determining the fate and transport of triclosan in the environment. Nevertheless, the factors affecting biodegradation of triclosan and the toxicity potential of its degradation metabolites are largely unknown, making assessing the fate and transport of triclosan in engineered systems and natural environment unrealistic. .

Goal and Objectives

To this end, the **goal** of this research is (i) to use molecular assays to determine the biodegradation potential of triclosan in Texas rivers, and (ii) to apply *in-vitro* bioassays to evaluate the toxicity potential of triclosan biodegradation metabolites. Two specific objectives are described as follows:

Objective 1: Determine the types and quantity of known triclosan-degrading bacteria in Texas river water using molecular assays. Our lab has successfully developed a suite of real-time PCR assays for quantification of known triclosan-degrading bacteria. I will

apply the developed assays to Texas river water and different biological wastewater treatment processes to assess the biodegradation potential of triclosan.

Objective 2: Determine the toxicity potential of triclosan degradation metabolites in Taxes river water using two different *in-vitro* bioluminescent yeast (*Saccharomyces cerevisiae*) androgenic/estrogenic screening bioassays. The bioluminescent assays are very sensitive to the presence of endocrine disrupting compounds, including triclosan, in water samples. I have successfully applied these assays to water samples containing triclosan and its metabolites. In this study, I will apply these bioassays to river water samples collected near the outfalls of wastewater treatment plants and the downstream of the receiving river. The results are expected to better assess the fate and transport of triclosan in river water.

Benefits to Texas

Water is a valuable resource to support the sustainable growth of our society and economy in Texas. According to the State Water Plan developed by the Texas Water Development Board (TWDB) in 2007, reuse of treated wastewater is necessary and is a viable option to meet the increasing fresh water demand in Texas from 2010 to 2060. In fact, Paso and Tarrant Regional Water Districts are currently practicing direct and indirect water reuse. In addition, using reclaimed water for groundwater recharge could ease the uncertainties of Texas water supply due to climate change and drought seasons. Results of this study are expected to provide meaningful tools to assess the biodegradation potential of triclosan as well as an estrogenic or androgenic potential in Texas rivers. Furthermore, the results from this research will provide fundamental knowledge in managing water resources and water quality in Texas waters

5. Academic Qualification:

B. Eng.	Civil and Environ. Eng.	Korea University, South Korea	GPR
M.S	Civil and Environ. Eng.	University of California at Berkeley	GPR
Ph.D Student	Civil and Environ. Eng.	Texas A&M University	GPR

GRE Scores: Total =; Verbal, Quantitative

Courses Taken:

Course Name	Grade	Course Name	Grade
ENVIRON ENGR PROC I		ADV BIOTECH ENV ENG	
ENVIRON ENGR PROC III		GIS ENV PROBLEM SOLVING	
BIOINFORMATICS		FUND NANO BIO ENGR	
POLYMER ENGINEERING		WRITING HLTH EDUCATORS	
STAT IN RESEARCH I			

6. Proposed Use of Funds: The cost of the project is estimated to be $60,000. If 2011-12 TWRI Mills Scholarship is awarded, the scholarship will be used for paying my tuition. This project demands extensive laboratory usage, materials and supplies, and use of analytical core facility at Texas A&M University campus. My advisor will support my research in terms of assisting on these costs.

7. Intended Career Path: My immediate goal is to complete my Ph.D. education at TAMU and publish high quality papers in top-tier journals. My ultimate career goal is to become a professor in academia where I can educate and interact with students who are interested in water resource and water quality issues.