2010-11 TWRI Mills Scholarship Application

1. **Name of student:** Parvathy Thelakkat Kochunarayanan
   TAMU student ID number:

2. **Contact information for student.**

3. **Name and contact information for committee chair.**

Dr. Kung-Hui Chu, P.E.
Assistant Professor
Zachry Department of Civil Engineering &
Interdisciplinary Faculty of Toxicology and Water Program
3136 TAMU, 205G WERC, College Station, TX 77843-3136
Tel: 979-845-1403 Fax: 979-862-1542
E-mail: kchu@civil.tamu.edu

4. **Description of the student's proposed research, emphasizing how it will address water resources-related concern (particularly how, if possible, it will benefit Texas).**

Goals/Objectives

The overall goal of my research is to better understand the biodegradation of perfluorinated compounds in order to develop cost-effective biological treatment processes for these compounds. The main objective of this research project is to examine biodegradation potential of two concerned perfluorinated compounds, Perfluorooctane sulfonate (PFOS) and Perfluorooctanoate (PFOA) under anaerobic conditions

Need for Research

Perfluorooctane sulfonate (PFOS) and Perfluorooctanoate (PFOA) are two environmentally persistent compounds coming under the group of perfluorinated compounds. These compounds exhibit high thermal, oxidative resistance and are good repellants of water and oil. They are widely used in non-stick, water and stain proof coatings, protective coatings, high temperature lubricants etc. Such widespread use in industrial and consumer products such as non-stick pans, carpets, shampoos, household cleaners and so on has resulted in the detection of these compounds globally in water bodies, environment, humans as well as in wildlife. These compounds can be indirectly produced from the degradation of precursors such as fluorotelomer alcohols. PFOA and PFOS are currently listed in Environmental Protection Agency's drinking water Contaminant Candidate List (CCL 3). Existing literature confirms drinking water contamination of tap and surface water samples by PFOA and PFOS in many countries and trace level detection of these chemicals in ocean waters. Undoubtedly these compounds have posed emerging threat to water quality.

The carbon- fluorine bond present in PFOA and PFOS is the strongest covalent bond known making them difficult to be removed by conventional water and wastewater treatment processes. They can be removed by advanced chemical techniques. However most of these techniques need incineration of concentrated waste in the final step to complete destruction which can be avoided by adopting biological degradation. Even though the possibility of biodegradation is discussed in a few papers based on thermodynamic data and calculations, a lack of experimental research in this area is notable. No particular bacteria have been identified yet capable of degrading PFOA and PFOS. This project would be a unique study focusing on the biodegradation potential of PFOA and PFOS. Biological degradation is a desirable option from water quality and water resources standpoint when compared with other chemical degradation techniques and any development in this direction will be a breakthrough.

Benefits to Texas

Direct and indirect water reuse is a promising fresh water source for the future in Texas. Currently, Texas is practicing both direct and indirect water reuse, mainly in El Paso and Tarrant Regional Water Districts. The Texas Water Development Board (TWDB)'s State Water Plan (2007) projected that over the next 50 years - from 2010 to 2060, wastewater reuse throughout the State using existing infrastructure will reach about 1.3 million acre-feet. The use of reclaimed water for groundwater recharge has been proposed as a good strategy to address uncertainties of Texas water supply due to climate change and in particular, drought. Thus, there is a need of high water quality for reclaimed water. Presence of chemicals, such as PFOA and PFOS, in reclaimed water will in no doubt impede the progress of water reuse in Texas and potentially the sustainability of water in Texas. The results of this study are expected to provide fundamental knowledge for developing effective treatment processes for PFOA/PFOS and for assessing/predicting the fate of these compounds in surface water, soil and groundwater.

5. Academic qualifications of the student, including undergraduate and graduate GPR, GRE scores, courses taken and grades.

Undergraduate level

Bachelor of Technology in Civil Engineering
College of Engineering Trivandrum, Kerala (University of Kerala, India)
GPR:

GRE scores

Graduate level

Master of Science (Specialization: Environmental Engineering)
Zachry Department of Civil Engineering
Texas A&M University
GPR:

Courses taken at graduate level	Grades	Term
CVEN 601		
CVEN 620		
CVEN 682		
CVEN 603		
CVEN 604		
CVEN 627		

6. Proposed use of funds resulting from this scholarship

The estimated total cost for this project is $60,000. The tuition rate is $8,981 per year (effective Fall 2009), with at least 5% increase every year. The scholarship amount will be mainly 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 the student anticipates pursuing

I am planning to continue my studies to a PhD in this field. My long term objective is to take up lead consultant and researcher roles in Environmental Engineering, where I can use my education and training make fundamental contributions to the theory and practice of Environmental Engineering.