

Application form for 2008~2009 TWRI Mills scholarship program

1. Name: Sanghyun Kim

2. Contact information for student:

3. Name and contact information for faculty advisor: Name: Dr. Autenrieth (Robin Autenrieth), E-mail: rautenrieth@civil.tamu.edu, Phone #: 979-845-3593

4. Description of student's proposed research

The presence of steroid hormones at surprisingly low concentrations (ng/L) in the environment has been linked to ecosystem and potential adverse effects on humans. Sometimes referred to as endocrine disrupting compounds (EDCs), their sources are many, but discharges from wastewater treatment plants and nonpoint sources. Notably confined animal feeding operations (CAFOs), are considered the largest contributors. One of the potential nonpoint sources of steroid hormones are releases from poultry amended fields where the litter is being used to replenish nutrients, organic carbon, and improve other soil properties. The steroid hormones present in the litter are due to natural excretions as are the nutrients. Working in collaboration with personnel at the Agricultural Research Station in Reisel, Texas we have determined that release of excess nutrients and steroid hormones can be significantly reduced by agricultural practices. For those EDCs that enter surface waters, their fate can be largely dependent on their biodegradation potential.

Preliminary studies in our lab have demonstrated that estrogen can be biodegraded via co-metabolism by ammonia oxidizing bacteria (AOB). Shi and Fujisawa (2004) demonstrated that nitrifying activated sludge (NAS) successfully degraded this group of EDCs. In the proposed research, cometabolic kinetics for estrogen biodegradation using a pure culture, *Nitrosomonas europae*, and a mixed wild culture originating from turkey litter applied to the Reisel fields will be evaluated. Under aerobic conditions, extant kinetic studies will be conducted to generate parameters for testing in four model simulations to determine the most appropriate mechanistic explanation. The kinetic model for ammonia degradation and four models appropriate for estrogen cometabolism include first order, competition, reductant, and combined model (Alverz-Cohen and Speitel 2001). Using nonlinear regression analysis to fit the potential models to the experimental data based on 4th order Runge-Kutta numerical approximation, the appropriate model will be identified. From these results will be determined the conditions under which microbial degradation can be enhanced, the extent of biodegradation that can be expected, and the rate at which this biodegradation will occur. GC/MS is used to quantify the estrogens; ammonia nitrogen is analyzed by HACH ammonia kit, and nitrate and nitrite are analyzed by ion chromatography. The experimental protocols have been developed and proven effective.

The use of field amendments serves the purpose of improving soil quality and provides a means of managing waste generated from CAFO operations. Management of these practices in a manner that prevents unintentional consequences is essential to ensure watershed protection and sustainable multiple

use of common resources. This research will provide some of the answers needed to achieve this balance.

6. Proposed use of funds resulting from this Scholarship

- The majority of the scholarship will be spent on tuition for next semester and purchase of chemicals

7. Intended career path the student anticipates pursuing

- After getting Ph.D degree, I will seek a faculty position at a U.S. institution where I can continue my research for steroid hormone removal in engineered systems