Fall 2008 EWRE Seminar Series

August 29, 2008

3:30 PM ECJ 1.204

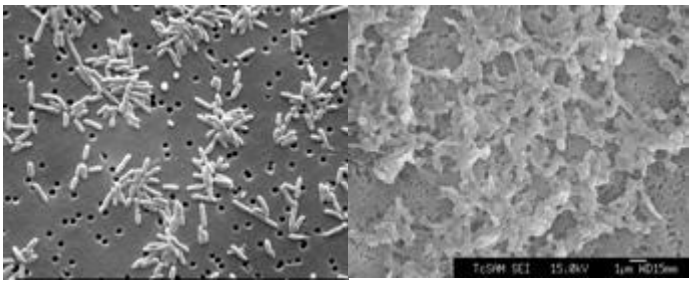
Shankar Chellam, Ph.D.
Associate Professor
Department of Civil and Environmental Engineering
Department of Chemical and Biomolecular Engineering
University of Houston, Houston, TX

Bacterial fouling of microfiltration membranes

First, an overview of on-going research in my labs will be presented followed by a detailed discussion of the mechanisms of bacterial fouling of microfiltration membranes over two different time scales. Both experimental and numerical results will be discussed.

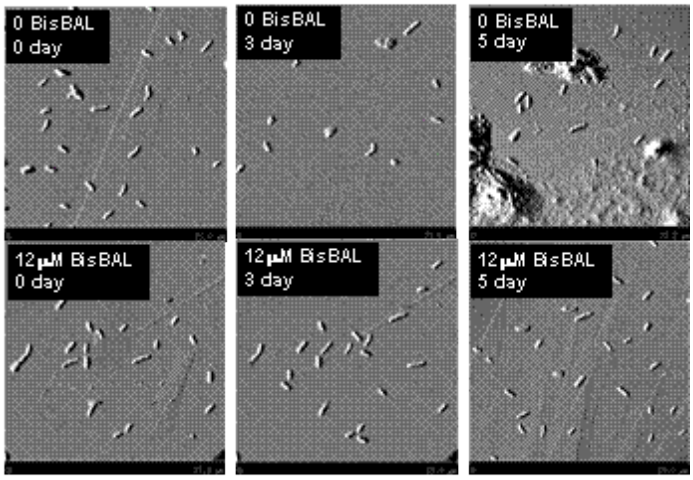
Constant pressure and constant flux experiments were performed using track-etched polycarbonate membranes and rod shaped bacteria viz. Brevundimonas diminuta and Serratia marcescens to study flux decline and backwashing during the early stages of microfiltration. The initial stages of flux decline prior to the secretion of new extracellular polymeric substances (EPS) were quantitatively described by the intermediate blocking law before transitioning to cake filtration at later times. Recent computational simulations reveal that the non-uniform porosity of track-etched membranes contributes to bacterial clumping on the surface prior to cake formation.

New blocking law models for constant flux microfiltration of cakes compressing in a straight-line and power law manner were also derived and validated experimentally using bacteria and coagulated natural colloids. Bacteria were easily removed following short filtration times before significant secretion of new EPS by simply rinsing with ultrapure water thereby completely restoring the clean membrane permeability. In contrast, this rinsing procedure did not completely recover the membrane permeability following longer durations when significant amounts of new EPS proteins and polysaccharides were secreted. Consequently, backwashing effectiveness during water and wastewater microfiltration will be high prior to EPS production whereas flux recovery may not be possible solely by hydrodynamic means once EPS are secreted.



The presentation will conclude with some recent results on EPS characterization using spectroscopy and microscopy as well as EPS control using a bismuth thiol and its implications for membrane fouling. A 2:1 molar ratio preparation of bismuth with lipophilic dithiols and monothiols significantly reduced EPS expression in suspended cultures at levels

just below the minimum inhibitory concentration (MIC). Total polysaccharides and proteins secreted decreased by approximately 95% over a 5-day period when exposed to a bismuth-BAL chelate (BisBAL) at near MIC. FTIR spectroscopy suggested that a possible mechanism of biofilm disruption by BisBAL is the inhibition of carbohydrate O-acetylation. FTIR also revealed extensive homology between EPS samples with and without BisBAL treatment, with proteins, polysaccharides, and peptides varying predominantly only in the amount expressed. EPS secretion decreased following BisBAL treatment as verified by atomic force microscopy and scanning electron microscopy. Without BisBAL treatment, a slime-like EPS matrix was secreted that resulted in biofouling and inefficient hydrodynamic backwashing of microfiltration membranes.



September 4, 2008

3:30 PM ECJ 1.204

Nathan W. Johnson
Ph.D. Candidate

Mercury Methylation and Partitioning beneath an In-Situ Sediment Cap

In-situ capping has shown promise as a management strategy for contaminated aquatic sediments, however, little is known about how mercury methylation in underlying sediments will be affected. Changes to the location and extent of sulfate reduction and other anaerobic biological processes in underlying sediments were studied in laboratory microcosms. An upward translation in methylmercury concomitant with an upward shift in biogeochemical redox zones was observed beneath an in-situ sediment cap. A 1-dimensional, unsteady, reaction transport model was developed and used to interpret the results. Simulated anaerobic biological activity, including sulfate reduction, translated upwards following the placement of a sediment cap, consistent with observations of increased methylmercury at shallower depths. Additional experiments are planned that will examine methylmercury production and solid-phase partitioning in individual biogeochemical conditions likely to occur beneath a sediment cap.

September 11, 2008

3:30 PM ECJ 1.204

Amanda Van Epps
B.S. Chemical Engineering, Stanford University, 2001

Examining the Role of Regulatory Impact Assessments and Environmental Impact Assessments in Integrating Environmental Justice into Federal Policies and Programs

The environmental justice (EJ) movement originated at the local level when residents of low-income and minority communities began to resist siting of hazardous waste landfills and other environmental threats in their communities. One early attempt to regulate environmental justice and make it an enforceable mandate was federal Executive Order 12898, issued in 1994 and intended to impact the workings of government at the highest levels â€" the decisions of federal agencies. Federal agencies have taken a variety of steps to incorporate environmental justice into their programs and practices. This study evaluates Regulatory Impact Assessments (RIA) and Environmental Impact Statements (EIS) across three federal agencies (DOE, DOT, EPA) to compare the extent to which EJ is addressed at these two scales, across agencies, and over time. By searching agency documents for key EJ variables, such as site, population, and impact characteristics, a template was developed to determine if RIAs and EISs include sufficient information to identify disproportionate impacts of proposed regulations or projects on minority and low-income communities.

David Lampert, Ph.D. Candidate
B.S. Civil Engineering, Oklahoma State University, 2001
M.S. Civil Engineering, U.T. Austin, 2003

The Significance of Pore Water Concentrations for Assessment and Remediation of Contaminated Sediments

Due to poor source control in the past, many hydrophobic organic contaminants such as polycyclic aromatic hydrocarbons (PAHs) have been released into the environment. The ultimate source for this contamination is often sediments. The risks associated with contaminated sediments are driven by accumulation in benthic (sediment-dwelling) organisms. Contaminant uptake is thought to be driven by pore water concentrations, which have demonstrated a better correlation with bioaccumulation than sediment-phase concentrations. One explanation for this result is that actual pore water concentrations are much lower than those predicted by classic (focKoc) sorption predictions, which is termed desorption resistance. A promising technology for management of contaminated sediments is capping, which is placing a layer of clean material over contaminated sediments to provide a suitable habitat for benthic organisms and contain the contamination. Predicting the effectiveness of capping requires mathematical models that incorporate the many different physical phenomena governing contaminant transport in sediments. Solid-phase concentrations provide a poor metric for evaluating contaminant migration due to the different affinities of cap materials for contaminants. Pore water concentrations, however, provide an unbiased estimate of contaminant migration. For these reasons, much focus has been on quantifying in situ pore water concentrations in sediments. Direct analysis of pore water concentrations is often impossible due to the hydrophobic nature of sediment contaminants. Solid phase microextraction (SPME) provides a means of quantifying pore water concentrations at the parts per trillion level. A field SPME sampling device has been developed for quantifying pore water profiles in the sediments and sediment caps. In this discussion, work done relating to the importance of pore water and the results of the SPME analysis will be discussed.

September 18, 2008

3:30 PM ECJ 1.204

Dr. Mary Jo Kirisits
Assistant Professor

Laboratory Safety

Many Environmental and Water Resources Engineering graduate students work in the laboratories, and we want this to be a safe experience for everyone involved.Â The purpose of this seminar will be to highlight important aspects of chemical and biological laboratory safety, including things that you should do and things that you should not do.

September 26, 2008

3:30 PM ECJ 1.204

Friday, September 26
2:00 PM WRW 102

KAPPE LECTURE

Jeannette A. Brown
Executive Director, Stamford Water Pollution Control Authority
Stamford, CT

Unique Biosolids Management Program

The lecture describes various aspects of biosolids management in Stamford, CT including public acceptance, regulatory issues, permitting requirements, research and development program, energy management districts, and facilities for generation of electricity.

The Kappe Lecture is free to the public.

Refreshments immediately following in ACES atrium.

October 2, 2008

3:30 PM ECJ 1.204

Donghyun Rim
M.S. Civil Engineering, UT Austin, 2005
B.S. Civil Engineering, Hanyang University, Seoul, Korea, 2003

Ozone Reaction with Occupant Surface and its Effect on Breathing Air Quality

Ozone has been shown to be associated with mortality and morbidity, even at relatively low levels. Ozone reaction products such as aldehydes, ketones, carboxylic acids, and secondary organic aerosols result in eye and airway irritation, limited respiratory flow and possible

long-term sensitization. The objective of this study is to estimate breathing zone levels of ozone and ozone reaction products associated with human surfaces (ORPHS). Computational fluid dynamics (CFD) model simulated an occupant in ventilated rooms. The CFD simulation methodology was validated experimentally, with an ozone reactive surface. The study found that breathing zone ozone levels can be substantially lower and ORPHS levels considerably higher than room levels due to ozone deposition onto the occupant surface. Depending on the airflow distribution in a space, the breathing concentrations of ozone range 60 - 80 % of the room air concentration whereas ORPHS levels are up to 6 times higher than the room level.

Ernest S. C. To
B.S. Civil Engineering, University of Texas at Austin, 1996
M.S. Civil and Environmental Engineering, Cornell University, 2001

Hypoxia modeling in Corpus Christi Bay using a Hydrologic Information System

Hypoxia is the depletion of dissolved oxygen to levels harmful to aquatic organisms. It is a common environmental problem that occurs in many coastal water bodies in the United States. In Corpus Christi Bay in Texas, hypoxia is known to cause a ten-fold reduction in the population of benthic species. To study this problem a team of scientists and engineers was formed. A Hydrologic Information System (HIS) has been implemented for the Bay to enable data from the different environmental sensor networks to be published and accessed in a unified manner. This presentation accounts for the process by which the Corpus Christi Bay HIS has supported the study and modeling of hypoxia. It also relates how opportunities for gaining scientific insights emerge with the inclusion of each additional sensor network into the HIS. It provides examples of methods for interpreting the data, such as space-time interpolation and hypotheses testing, so as to acquire knowledge. Finally, it describes the hypoxia model that is built from the acquired knowledge and how it can be enhanced by expanding the current HIS to new sources of data. The goal of this research is to demonstrate that hydrologic information systems, and thus cyberinfrastructures, are a very useful asset to scientific discovery. They are emerging as an indispensable component in future collaborative environmental research.

October 9, 2008

3:30 PM ECJ 1.204

David L. Sedlak

Department of Civil and Environmental Engineering
University of California, Berkeley

Engineering Surface Waters to Minimize the Impacts of Steroid Hormones and Related Compounds

Since the first reports that steroid hormones in wastewater effluent cause feminization of fish, considerable effort has been directed at modification of wastewater treatment plants to enhance the removal of trace organic compounds. However, advanced treatment methods do not control all of the contaminants of concern and in some cases plant modification may not be practical. Furthermore, we have recently documented numerous difficult-to-control sources of endocrinedisrupting compounds that are not associated with wastewater treatment plants. To address these issues, environmental engineers may need to engineer surface waters to remove organic contaminants. Engineered treatment wetlands hold great

promise as passive treatment systems for contaminant removal because they are inexpensive and aesthetically appealing. Building reliable and effective treatment wetlands will require the development of a better understanding of the attenuation processes that occur in surface waters and methods for controlling naturally occurring processes. In many cases, the challenges associated with the engineering of surface waters will be similar (but more difficult) than those faced by the designers of conventional wastewater treatment plants and will require students trained in chemistry, biology and fluid mechanics.

October 16, 2008

3:30 PM ECJ 1.204

Scott Hekman
B.S. in Engineering with an emphasis in Civil/Environmental Engineering - Calvin College

Improved Concentrate Recovery for Reverse Osmosis Treatment of Brackish Groundwater

In arid (and even semi-arid) regions of the world, development threatens to exhaust water resources. Access to affordable water has become the limiting factor in growth for these regions. Reverse osmosis (RO) of seawater and brackish groundwaters is one solution to this problem. However, the recovery (fraction of influent water that becomes product water) is low, and disposal of the remaining water is expensive in inland applications. Antiscalants are used to prevent precipitation on the RO membrane surface and improve recovery, but their range is limited. Our work focuses on a side-stream process which takes the RO concentrate stream and inactivates the antiscalants with "peroxone" (ozone plus hydrogen peroxide). The concentrate is then exposed to conditions favorable for precipitation (elevated pH) before it is forced through a solid/liquid separation process. The permeate of the solid/liquid separation is then sent to a final RO membrane to increase the overall recovery of the system. By varying antiscalant type, oxidation conditions, and precipitation parameters, an optimal treatment for a given water may be obtained.

Catherine Mukai
B.S., Chemical Engineering, University of California - Berkeley (2005)

Particle Resuspension as a Function of Turbulence Intensity

Particles deposited onto surfaces, such as floors and heating, ventilation, and air conditioning (HVAC) ducts, can be resuspended into the air and affect indoor air quality. HVAC systems and human activities, such as walking, can act to disperse pollutants such as pollen and allergens, with possible adverse effects on human health. In this investigation, we examine the impacts of bulk velocity and turbulence intensity of the passing air stream on particle resuspension. Studies were conducted in a wind tunnel using hot-wire anemometry to control and measure the impacts of the flow properties of an air stream passing over a substrate seeded with polydisperse KCl particles. We evaluated resuspension from surfaces representative of common ducting and building materials, including galvanized sheet metal, carpet, and linoleum flooring . The tested particles were in the range of 0.5 to 20 microns, with higher relative resuspension seen for larger particles. The results suggest that bulk velocity and particle size are insufficient to predict resuspension from real surfaces, and that knowledge of turbulence is required for accurate assessment of resuspension critical velocities. The results can be applied to real buildings to determine the magnitude of resuspension and its contribution to indoor particle concentrations.

October 23, 3008

3:30 PM ECJ 1.204

Gookyoung Heo, Ph.D. Candidate
B.S. Chemistry, Seoul National University, Seoul, South Korea
M.S. Environmental Management, Seoul National University, Seoul, South Korea

Evaluation of toluene mechanisms developed for use in Carbon Bond 05 (CB05) by environmental chamber simulations

Aromatic compounds such as toluene are atmospherically important in urban areas due to their relatively high reactivities towards hydroxyl (OH) radicals and high emissions from automobiles and solvents. The Carbon Bond 2005 (CB05) mechanism is one of the most frequently used chemical mechanisms for regulatory photochemical air quality modeling in the US. However, the toluene mechanism in the current CB05 is nearly the same as in Carbon Bond IV (CB-IV) whose toluene mechanism was developed nearly 20 years ago. In the summer of 2008, four alternative toluene mechanisms for use in CB05 were proposed by CB05 mechanism developers, Dr. Greg Yarwood and Dr. Gary Z. Whitten, in collaboration with researchers at the Center of Energy and Environmental Resources, the University of Texas at Austin. Those newly proposed toluene mechanisms as well as the current toluene mechanism in CB05 were tested against 42 non-blacklight toluene-NOx experiments drawn from environmental chambers at the Universities of California-Riverside and North Carolina. For low-NOx experiments where initial NOx levels were lower than 100 ppbv as under typical ambient conditions, the current CB05 toluene mechanism (CB05-Base) tended to under-predict the maximum O3, O3 production rate, and NOx depletion rate. Those four modified CB05 toluene mechanisms all improved performance to varying degrees, and lowering the cresol yield from 0.36, used in CB05-Base, to 0.18 improved simulations of cresol. Among the four modified CB05 toluene mechanisms, CB05-UNClite, a mechanism based on the detailed toluene photo-oxidation mechanisms of Hu *et al.* (*Atmos. Environ.* **41**, 6478-6496, 2007), showed the most promising performance in predicting O3 and the NOx crossover time when NO equals NO2. In this presentation, evaluation results will be presented and discussed in terms of radical sources and NOx sinks.

Paula Kulis, Ph.D. Candidate
B.Sc. Environmental Engineering Science, Massachusetts Institute of Technology
M.S.E. Environmental and Water Resources Engineering, University of Texas at Austin

Modeling Gravity Currents in Shallow Fluid Systems

Dense underflows occur frequently in natural water, but they are often difficult to capture in a 3D hydrodynamic model. In Corpus Christi Bay, Texas, dense underflows may play a significant role in episodic development of bottom water hypoxia. Because Corpus Christi Bay is only 4 m deep, the influence of wind on the water column density stratification is likely important. This presentation shows an algorithm for parameterizing vertical mixing between an underflow and an ambient water body that is based on the turbulent kinetic energy present in the ambient water. Our algorithm implicitly accounts for wind, shear, and other larger scale forces in the ambient water, while also accounting for smaller scale motions within the underflow.

October 30, 2008

3:30 PM ECJ 1.204

Donna A. Kunkel
B.S. Physics, Texas A&M University, 2006

Reducing exposure to indoor ozone with passive techniques

A zero to low-energy method for removing gas-phase indoor pollutants using reactive building materials was developed. Two materials, unpainted gypsum wallboard (GWB) and an activated carbon mat (AC) were studied in laboratory and test house experiments for their effectiveness at removing ozone. Mean deposition velocities were 2.4 m hr-1 for GWB and 5.3 m hr-1 for AC in the chamber. Deposition had a strong dependence on ambient air speed, with deposition velocities reaching over 50 m hr-1 for AC in the test house. Ozone removal increased approximately 30 to 50% over background with GWB or AC present in a bedroom environment. A model was developed to estimate removal effectiveness in real world environments, with an effectiveness of greater than 80% possible.

Dharhas Pothina, Ph.D
M.S.E. Aerospace Engineering, University of Texas at Austin
B.Tech. Aerospace Engineering, Indian Institute of Technology Madras

A coupled model approach to modeling deep navigational channels in shallow bays

Physical phenomena, taking place on large domains, are usually associated with the coexistence of heterogeneous physical features, often localized in specific portions of the domain. The mathematical modeling of such phenomena can have high computational costs. Our particular problem of a navigational channel in a shallow bay is a good example of the above. Accurate modeling of bay circulation is an issue of great importance to many commercial and governmental entities all over the world. By modeling bay circulation, estuarine conditions like hypoxia and extent of salinity intrusion can be studied. In many bays, the numerical modeling is complicated by the presence of one or more dredged navigational channels. Often these channels are very narrow and very deep compared to the surrounding bay. This issue is excerbated in extremely shallow bays like Matagorda bay and Galveston bay in Texas. This drastic change in bathymetry makes modeling the system problematic. In order to accurately model the bay, the model should capture the effect of the spatially localized navigational channel. In general, applying sufficient grid resolution both in the vertical and horizontal should result in a reasonable simulation. Typically however, in real life applications the computational resources needed for such a simulation are not readily available and rarely is the time taken to do detailed studies as to whether the vertical turbulence model makes sense in view of the coarse vertical resolution used. The research aims to explore the extent of the problem and the ability of a coupled model approach to conduct reasonable simulations at a lower computational cost. The research will explore the coupling of a navigational channel model with a shallow bay model.

November 6, 2008

3:30 PM ECJ 1.204

Cédric David
M.S. General Engineering, École Centrale de Lille
M.S. Environmental and Water Resources Engineering, UT-Austin

Towards the calculation of river flow at regional and continental scales

Today, meteorological models can predict storm events and climate patterns and the quality of radar rainfall observation is increasing. However, there are few models that connect atmospheric models and datasets to the hydraulics of rivers. Such a model is necessary to advance the prediction of events such as floods or droughts.

The objective of our work is to develop RAPID (Routing Application for Parallel computation of Discharge). RAPID is a physically-based river routing model that has specific treatment for manmade infrastructures and anthropogenic actions (dams, pumping, etc.) through direct accounting of gage measurements. RAPID uses the mapped rivers and streams available in the NHDPlus dataset as its river network. RAPID is designed to run on high performance parallel computers and has been implemented on the Lonestar supercomputer (http://www.tacc.utexas.edu/resources/hpcsystems/) at the Texas Advanced Computing Center.

Chi P. Hoang
B.S. Environmental Engineering, Hanoi University of Technology
M.Eng. Environmental Engineering, University of Toronto

Resistance of green building materials to mold growth

Mold growth in buildings is attracting increasing public attention due to the adverse effects of fungal bio-aerosols on building occupants. Although several studies have examined fungal growth on conventional building materials in dry and wet environments, little published work exists related to the biological reactivity of so-called "green" materials. The objective of this study was to develop a new method for investigating the effects of external nutrient levels, host materials, spore levels, and surfactants on the susceptibility of test materials to a model fungal species. Results indicate that a correlation exists between water availability and the susceptibility of some materials to fungal growth. The results of this study also suggest that spore concentrations, nutrient availability, and surfactants affect fungal growth capacity on test materials. Finally, materials which are initially mold-resistant may become more susceptible to mold growth when soiled with an organic layer.

November 13, 2008

3:30 PM ECJ 1.204

Lee Blaney
M.S. Environmental Engineering, Lehigh University (2007)
B.S. Environmental Engineering, Lehigh University (2005)

Advanced Oxidation of Ciprofloxacin: Impact of Organic Matter and Characterization of Antibiotic Activity

Two critical issues associated with application of advanced oxidation processes for drinking water treatment of pharmaceutically active compounds (PhACs) are composition of the background organic matter matrix and residual pharmaceutical activity (i.e., post-treatment pharmaceutical activity associated with the target compound and/or its derivatives). With the increased prevalence of water reuse operations, proper treatment design must consider

the characteristic differences between human-impacted and natural organic matter. Because pharmaceutical activity represents a threat to human health, our research efforts focus on establishing metrics that describe the residual pharmaceutical activity of treated water streams.

This research employed the peroxone (ozone/hydrogen peroxide) process to oxidize the antibiotic drug ciprofloxacin. Experimentation was conducted in a semi-batch system, consisting of a gas-washing bottle, which contained the solution, being fed by a gaseous ozone stream. Samples were taken at pre-determined times that correlate with specific amounts of ozone reacted and hydroxyl radicals created.

Removal rates and reaction kinetics of ciprofloxacin from natural, reuse, and synthetic water sources were recorded. The natural water source was obtained from Lake Austin (Austin, TX); the reuse water source was taken from the Walnut Creek Wastewater Treatment Plant (Austin, TX) secondary effluent stream. Minimum inhibitory concentration bioassays (with Escherichia coli ATCC #25922) were utilized to determine the relationship between ciprofloxacin removal and residual antibiotic activity. This relationship is intended to provide insight regarding endpoint treatment goals for PhAC classes (i.e., antibiotic, anti-inflammatory, etc.), as opposed to individual PhACs.

Diana Hun
M.S. Architectural Engineering, University of Texas at Austin
B.S. Electrical Engineering, University of Texas at Austin

Residential exposure of Hispanics to hazardous air pollutants

There is increasing evidence that disparities in environmental exposures may disproportionately affect the health of ethnic minorities. These groups appear to be exposed to higher concentrations of hazardous air pollutants (HAPs) based on substitutes of exposure such as outdoor measurements. The objective of this research is to further these studies with exposure assessments that consider the contributions from the significant number of indoor sources
of HAPs, and the large fraction of time people spend indoors. Two exposure assessments are being evaluated: the Relationship of Indoor, Outdoor, and Personal Air (RIOPA) study, and the Houston Exposure to Air Toxics Study (HEATS). Results from the analysis of the Houston, TX, component of RIOPA indicates that the cumulative cancer risk among Mexican-Americans was 1.6 times greater than that of non-Hispanic Whites, which was mostly due to exposure to p-dichlorobenzene, chloroform and benzene. Additional evaluations are being performed to determine if these trends persist among all Hispanics who participated in RIOPA and HEATS.

November 20, 2008

3:30 PM ECJ 1.204

W. Andrew Jackson, Ph.D., P.E.
Department of Civil and Environmental Engineering, Texas Tech University

Extraterrestrial Biological Pretreatment-Implications for Treatment of Terrestrial Source Separated Waste Streams

Long term space habitation and exploration require high efficiency water recycling systems. Waste streams from space habitation contain high concentrations of both organic N and

ammonium and high ratios of N to organic C compared to terrestrial wastewater. As with terrestrial systems wastewater must be treated to remove organic carbon, nitrogen compounds, salts, and trace constituents. In general, either some type of reverse osmosis or distillation step is required as the final treatment prior to disinfection. However, the high waste strength can seriously impact the efficiency of these post-processors. Biological pre-treatment is one process capable of significant reductions in organic C and nitrogen. Biological systems are self sustaining and require minimal inputs of energy or consumables. Research in our lab has been conducted to evaluate a number of micro-gravity compatible biological nitrification-denitrification coupled systems. Reactor types include tubular pulsed flow reactors, packed bed reactors, membrane reactors and more recently a single vessel membrane reactor capable of simultaneous nitrification-denitrification (sNDN). This seminar will highlight the unique challenges of biologically treating extraterrestrial waste streams and their potential relevance to terrestrial systems.

November 27, 2008

THANKSGIVING

December 4, 2008

3:30 PM ECJ 1.204

Ashlynn Stillwell
B.S. Chemical Engineering, University of Missouri-Columbia (2006)

Energy-Water Nexus in Texas: An Overview

Energy and water are interrelated. We need energy to collect, treat, and distribute water and wastewater. Conversely, we need water for cooling during power generation. Current trends indicate a move toward more energy-intensive water supplies, such as desalinated brackish groundwater, and more water-intensive energy supplies, such as fossil fuel carbon sequestration. With limited energy and water resources and a growing Texas population, understanding the nexus of energy and water in Texas becomes important for resource planning and management. The locations of water supplies and power plants become as important as the capacity of such facilities, resulting in tradeoffs of additional energy or water use. This research project presents the current status of the energy-water nexus in Texas, as well as future case studies to serve as references for Texas policymakers regarding energy and water policy.

Mandana Ashouripashaki
B.S. Chemical Engineering, University of Tehran (1996)

Capillary pressure-fluid saturation curves in porous media containing water and air are well studied, when the medium is totally water wet or strongly water repellent. However, natural porous media are made of minerals which some are water-wet and others are oil-wet; thus real media have fractional or mixed wettability. The purpose of this study is to determine the air-water and oil-water capillary pressure-saturation imbibition and drainage curves of porous media as a function of wettability. Fractionally wet media was created by mixing certain portions of the water-wet and oil-wet sands. The obtained Pc-S data is modeled by modifying the Brooks-Corey model. The effect of contact angles on capillary pressure hysteresis is considered. In this study, the relation between capillary pressure and water

saturation in drainage; imbibition and secondary imbibition showed a distinctive shift in curves when the fraction of oil-wet grains increased.

Last Updated January 22, 2009