Title: High through-put dechlorination of TCE through Pd/xGnP and Pd-Au/xGnP hollow fiber nanocomposite membranes

Author: Christopher Crock

Abstract: "High through-put dechlorination of TCE through Pd/xGnP and Pd-Au/xGnP hollow fiber nanocomposite membranes"

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Palladium-based catalysis has emerged as a promising approach to the reactive treatment of recalcitrant water pollutants such as halogenated organics. However, several technical challenges including low catalyst activity and fouling hinder field-scale applications of this technology. Using membrane reactors for catalysis can be advantageous in several aspects. First, in catalytic membranes the diffusional limitation is mitigated due to the small size of pores and the rate of mass transfer of pollutants to the catalyst surface can be regulated by the rate of permeation. Second, reactive membranes obviate the need to recover the catalyst. Third, membrane reactors may eliminate catalyst poisoning or fouling by rejecting foulants at the feed-membrane interface. Immobilizing catalysts on various supports prior to incorporating them into membranes enables better catalyst dispersion throughout the membrane and may minimize catalyst loss to the permeate flow.

We report on the preparation of two Pd-based catalysts on an exfoliated graphite support for TCE hydrodechlorination. We have fabricated Pd/xGnP and Pd-Au/xGnP catalysts and incorporated them in hollow-fiber membranes. To our knowledge, this is the first report on Pd and Pd-Au catalysts on a graphene-type support for hydrodechlorination of TCE in hollow-fiber membranes.

There was collaboration of this project between Istanbul Technical University (ITU) and Michigan State University (MSU) as part of the Partnership for International Research and Education. The catalysts were fabricated and characterized at MSU, while the hollow fiber nanocomposite membranes were fabricated at ITU. In this collaboration MSU researchers traveled to ITU for two weeks for hollow-fiber fabrication. The research trip was an excellent opportunity to participate on an international team and develop awareness about global and international sustainability and water issues. Both MSU and ITU teams needed to communicate effectively in order to carry out efficient research. From this collaboration, we will be submitting a paper for publication based on this research.
Title: Does Decentralized Community-Based Water Governance Improve Access to Potable water in Peri-Urban and Informal Settlements? Evidence from Malawi

Author: Ellis Adams

Abstract: More than 8000 people, including 4500 children under age 5, die unnecessarily from lack of potable water access in Malawi every year. This is a growing concern especially in the informal settlements where several thousands of people rely on few public-water kiosks. Peri-urban demand for potable water continues to intensify from population growth and rapid urbanization. Currently, over 76 percent of Malawi’s current urban population lives in the peri-urban and informal settlements where high population densities, inadequate infrastructure, poverty, and insecure tenure exacerbate the challenge of providing water.

Consistent with experiences across Sub-Saharan Africa, centralized water-policies have proven unsuccessful for Malawi, and many peri-urban residents are still without potable water. This has shifted attention to community-based water governance approaches as an alternative option that emphasize the capacity of communities to diagnose and advance solutions to their own water problems. In 2006, the Malawi government transferred water-supply roles in peri-urban areas to Water User Associations (WUAs) as part of broad decentralization programs. Based on fieldwork in the peri-urban areas of Lilongwe, Malawi’s capital and largest city, this study investigated the emergence of community-based water supply for peri-urban areas. Specifically, we examined whether decentralized community-based institutions can improve access to potable water in peri-urban areas.

The main contribution of this work stems from answering an important question: what happens when community-based approaches, traditional used in rural areas, gets transferred to peri-urban areas as a policy option? How does the commodified nature of water, sold in a demand-based setting with expectations of cost-recovery, and the complex nature of a peri-urban setting often neglected by governments for reasons such as: lack of legitimate tenure, overcrowding, and limited potential to recover costs affect such approaches? In answering this question, the study demonstrated that while a business-based WUA model can enhance water supply and access, the urban/peri-urban space, characterized often by heterogeneity and limited social cohesion imply a trade-off between water-supply and social goals of ownership, participation, and empowerment.
Title: Collaboration with Singapore leads to a better understanding of the filtration of oily wastewater

Author: Emily Tummons

Abstract: Many industries struggle to separate waste streams containing oil-water emulsions because few technologies are capable of separating micron sized oil droplets while remaining cost effective. Microfiltration and ultrafiltration membranes are often the best option, but overtime a fouling layer of oil develops on the membrane surface that causes the permeate flux to decline. The way in which oil fouls the membrane surface is not well understood due to the deformability of the oil droplets, but our collaboration with Singapore is attempting to elucidate this problem.

I utilized the Direct Observation Through the Membrane (DOTM) technique at the Singapore Membrane Technology Centre (SMTC) to gain insights into oil droplet behavior at the membrane surface. This collaboration allowed for me to work in the SMTC lab for 5 months alongside researchers and students that not only introduced me to new cultures and practices, but also provided me with new insight for my research. The results of this collaboration have led to the submission for a journal publication as well as another funded grant proposal, and the communication is still on going for new projects between MSU and Singapore that can advance the fundamental knowledge and the technologies used to keep our water sources safe and clean. My time in Singapore has taught me some invaluable travel tips and specific best practices for the country and I plan to share these and some coping strategies along with the research advantages that collaborating with Singapore provides.