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NOVEL TECHNOLOGIES FOR REMOVAL OF ARSENIC FROM WATER AND JUICE

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Contamination of drinking water and even juices and food with arsenic is widespread and new effective methods for its removal are vigorously being sought. Nanotechnology offers solutions to this problem since nanoparticles have been demonstrated to have useful absorption properties for removal of contaminants such as heavy metals and arsenic from drinking water. In this investigation we have found that the method of synthesis of the sorbent and its surface properties are the most important factors in how effective materials are for removal of arsenic from water. Indeed, a low surface area aggregated material can outperform a high surface area material that has insufficient Lewis acidity. Also, simple hard/soft acid/base chemical concepts can be used to produce materials that are excellent for removing both arsenic(V) and arsenic(III) from water. It can be difficult to take advantage of the useful properties of nanoparticles in the real world due to their small size. For example, in a water treatment column, they can simply suspend and flow away with the water or clog any filter that might be used to keep them in place. The backpressure in a packed column of nanoparticles makes them impractical for treatment of drinking water.

We addressed this challenge by finding a way to make spherical aggregates of nanoparticles that have a similar size and shape as the resin beads already used for water purification - indeed they are made from ion exchange resins. When a cationic ion exchange resin is loaded with a metal ion and then fired at 500-600°C, ceramic replicas are produced that are spherical aggregates of nanocrystalline (10-40 nm) metal oxides. In this manner, iron oxide, manganese oxide, and zinc oxide have been produced as porous aggregates with surface areas approximately 30 m2/g. The resulting materials show the same unusual adsorption behavior of nanoparticles but are much more easily handled. For example, nanocrystalline spherical particles of zinc oxide and hematite have proven very successful for removal of arsenic from water while the bulk materials are ineffective for this purpose. The recent challenge of removing arsenic from juices and rice syrup and drinks can also be met by nanotechnology. Since the juices are often also contaminated with heavy metals, we have also developed a complementary nanoparticulate reagent that can selectively absorb these toxins. This material has also been used to remove strontium from milk. Finally, we have moved beyond nanoparticles to metal-organic polymers that can utilize all of their metal content for arsenic removal rather than just surface atoms.

6:00-6:30 pm Reception
6:30-7:30 pm Dinner
7:30-8:30 pm Presentation
Oklahoma Christian University,
Gaylord Room, Gaylord University Center Building
2501 E. Memorial Rd. Edmond, OK 73013
http://www.oc.edu/map/ **Parking is free/unenforced after 5pm.**

OC campus map

Menu, Fajita Buffet
Chicken and Beef fajitas
grilled onions & peppers
Spanish rice
refried beans
lettuce, tomato
pico de gallo
salsa sour cream
chocolate and carrot cakes

Cost
$20 members
$5 students

RSVP Deadline
Thursday, April 11th, 5pm
Contact: Amanda Nichols
phone: 405-425-5420
email: amanda.nichols@oc.edu

Speaker Biosketch on next page

Allen Apblett Biographical Sketch

Allen Apblett received a B.Sc.(Honours) degree from The University of New Brunswick in 1984 and then graduate school at The University of Calgary under the supervision of Dr. Tristam Chivers where he received a Ph.D. in March 1989. He was awarded a Natural Sciences and Engineering Research Council Postdoctoral Fellowship that he took up at Harvard University in Dr. Andrew Barron's research group. In 1991 he became an assistant professor at Tulane University and then moved to Oklahoma State University in 1997 where he was recently promoted to Professor. He has published over 105 scientific papers or book chapters, and graduated 18 Ph.D. and 7 M.S. students from OSU. Among the awards that Dr. Apblett has received are the ACS Environmental Division Certificate of Merit, nomination as a member of Project Kaleidoscope's Faculty for the 21st Century, a Mortar Board Award for Excellence in Teaching, the Governor General of Canada's Medal, and a Lilly Endowment Teaching Fellowship and OSU's College of Arts and Science Junior Faculty Excellence in Research Award, He is also a Riata Fellow, a Fellow of the American Ceramic Society and last year's OSU Sigma Xi lecturer. He currently serves as councilor for the Oklahoma section of the ACS.