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Eastern South Dakota Water Conference

Call for Presentations

Abstracts to be considered for presentations on the topics listed in the table below or other key water topics at the November 1-2 *"2006 Eastern South Dakota Water Conference"* to be held in Brookings, SD, at the Swiftel Center will be accepted through July 15, 2006.

Please use the "Call for Presentations" form to submit your abstract via the conference website: http://wri.sdstate.edu/esdwc.

Students are encouraged to participate in the conference through a formal presentation or the student poster session.

Presenters whose papers are accepted for oral presentations are limited to a 30-minute talk including question and answer period. All speakers and student poster presenters must register for the Conference by October 1, 2006. The Early-Bird registration fee for speakers and other attendees is $60. A special student rate of $15 is available. Registrations received after October 1 are $75 for non-students and $20 for students. The fee includes dinner Wednesday evening, lunch on Thursday, breaks, and a notebook with abstracts.

Registration forms and the final agenda will be sent with the notification of acceptance.

The Eastern South Dakota Water Conference is sponsored by the USGS Water Science Center in Huron, SD, USGS Earth Resources Observation Systems (EROS) Data Center, East Dakota Water

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2006 ESDWC Concurrent Sessions	
Sessions will be organized around the following topics:	
Water Use Trends	
* Quality vs. Quantity	* Competing Uses vs. Economic Development
* Water Allocation vs. Use	* Municipal, Industry, and Agricultural Demands
Sustainable Water and Wastewater	
* Water Reuse and Conservation	* Innovative Water/Wastewater Treatment
* Infrastructure Development	* Treatment Technologies for Industry
Watershed Management	
* Manure Management	* Water Quality Requirements
* Land Use	* Wetlands Hydrology
* On-Site Wastewater	
Public Policy/Decision Making	
* Standards	* TMDLs
* Local Zoning	

Feature Project

SD WRI is pleased to feature a 2005 USGS 104b-funded project, *"Development of an Agglomeration Process to Increase the Efficiency of Limestone-Based Material to Remove Metals from Drinking Water."* The principal investigators for this project are Dr. Arden Davis, Professor in the Department of Geology and Geological Engineering, and Dr. David Dixon, Professor in the Department of Chemistry and Chemical Engineering, South Dakota School of Mines and Technology. Assisting them with research is Jenifer Sorensen, a Ph.D. student in Geology and Geological Engineering at SDSM&T.

By Jenifer Sorensen, PE

Metals contamination of drinking water is a major problem facing many areas of the United States and the world. There is a need for an inexpensive remediation technology for the removal of metals in drinking water that can be applied to small rural systems. The purpose of this research was to develop an agglomeration process to increase the efficiency of limestone-based material to remove select metals (arsenic, cadmium, and lead) from drinking water.

Arsenic is a persistent, bio-accumulative toxin. The maximum contaminant level (MCL) for arsenic, formerly 50 parts per billion (ppb), has been lowered to 10 ppb due to links with cancer. Arsenic poisoning in drinking water is a global problem, with up to 50 million people affected, and no easy treatment solution for rural wells and point-of-use systems is currently available. Long-term exposure to cadmium has the potential to cause kidney, liver, bone, and blood damage. The MCL for cadmium is 5 ppb. Lead is a well-known toxin that causes delays in the physical and mental development of children exposed to elevated levels. The action limit for lead is 15 ppb.

This project, as part of a larger, on-going study designed to develop and commercialize a limestone-based arsenic removal treatment technology, used the technique of agglomeration to improve metals removal efficiency of powdered limestone. Agglomeration, the process of taking fine materials and forming them into larger, spherical granules, provides a means to utilize the increase in surface area acquired through agglomeration while not compromising water flow through rates of the adsorbent material. Powdered cement binder is added to the limestone mix to bond the individual particles together and to strengthen the granules.

First, a bench-scale agglomeration process was developed. The design used was basically a closed system drum agglomerator, with a coffee can with three paddles attached on the inside as the drum. Using a closed system, material was put in the can, agglomerated, and removed. The can was rotated at about 50 revolutions per minute (rpm) and as the can rotated, water was sprayed into the can. A wide range of granule sizes were produced by this technique. After manufacture, the granules were sieved and dried for use in experiments. After drying, the granules are firm enough to hold their shape in a column and do not disintegrate when exposed to water because the cement binder is insoluble.

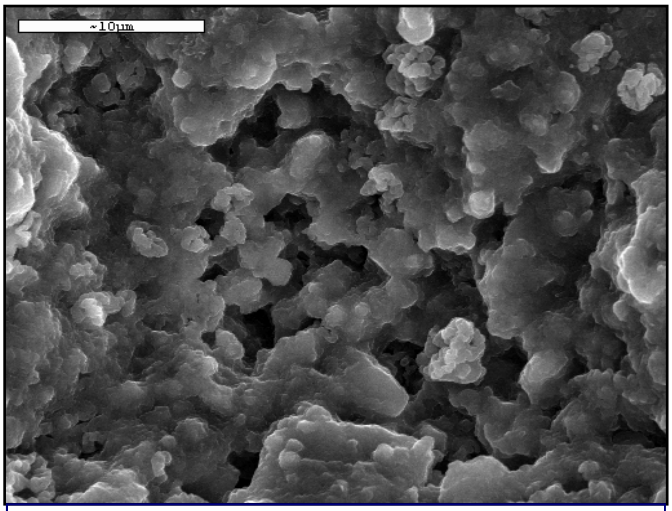

Figure 1. SEM photo of limestone-based granule.

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Feature Project

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Mixture formulas for the limestone-based granules were tested next, to determine the composition and size of granules to be manufactured. The optimum formula tested contained 87 percent limestone, 3 percent powdered reagent-grade magnesium carbonate additive, and 10 percent cement binder. Powdered

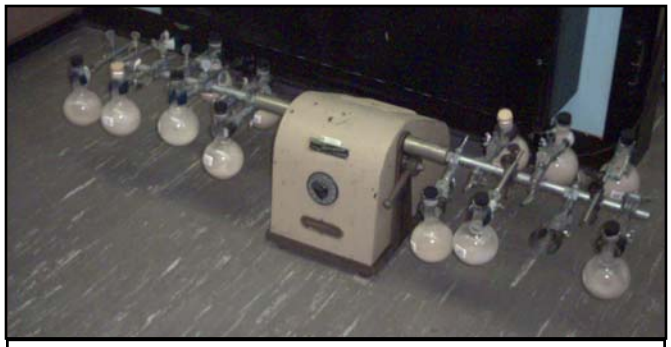

Figure 2. Batch experiment set up showing wrist shaker.

Minnekahta Limestone from the Black Hills was used as the limestone source. This material contains about 95 percent calcite, 4 percent quartz, and 1 percent microcline minerals, and has a surface area of about 1 m^2/g. The magnesium carbonate used has a surface area of about 22 m^2/g, and the surface area of the manufactured granules is about 4 to 6 m^2/g. The higher the surface area, the more reaction sites available on the material surface for dissolved metals. Figure 1 is a scanning electron micrograph (SEM) photo of the surface of a manufactured limestone-based granule. The fine grains of limestone are visible, connected by the cement binder.

Batch and column experiments were used to quantify the metals adsorption capacity of limestone-based granules. Adsorption is the chemical and physical process by which a substance dissolved in solution (such as metal ions) is concentrated onto the surface of a solid. Batch experiments are equilibrium experiments where a given amount of granules are added to a given amount of dissolved metals solution (either dissolved arsenic, cadmium, or lead). Flasks were shaken on a wrist shaker for two hours. Figure 2 shows a batch experiment set up. Column experiments (Figure 3) are dynamic tests, where rate of water flow and column length and diameter are important design variables.

The arsenic adsorption capacity of 1-2 mm sized limestone-based granules with 100 ppb arsenic starting solution was measured at 5.4 micrograms arsenic per gram of granules. As a comparison, an equal mass of limestone powder, ungranulated, has an arsenic capacity of 5.9 micrograms per gram limestone, and crushed limestone sieved to 1-2 mm size has an adsorption capacity of 4.2 micrograms per gram. Arsenic capacity of limestone-based granules is about equal to that of powdered limestone, with the added benefit that granules can be used as a filter media in a column treatment unit without impairing flow-through rates.

Batch experiments using cadmium starting concentrations of 5, 20, and 50 ppm showed that cadmium removal by limestone-based granules was greater than 99 percent. At an initial cadmium concentration of 5 ppm, adsorption capacity was 4.4 umol/gram, while it increased to 44.4 umol/gram at an initial cadmium concentration of 50 ppm. Batch experiments using lead starting concentrations of 0.5, 2, and 3 ppm, resulted in final lead concentrations below analysis detection

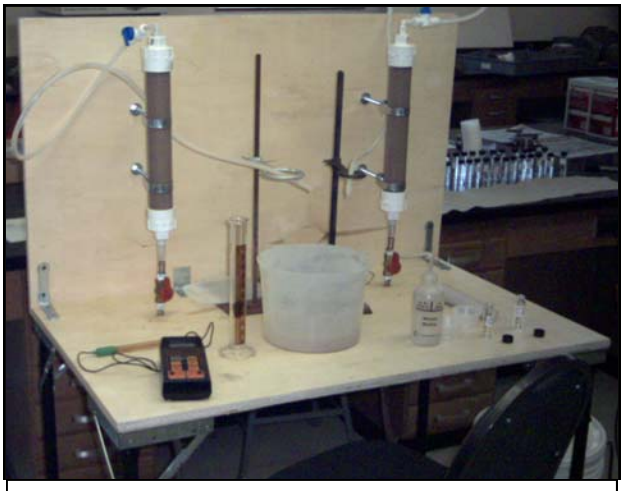

Figure 3. Column experiment set up.

South Dakota Drought Status Update
June 29, 2006

Dr. Dennis Todey is South Dakota's State Climatologist.
http://climate.sdstate.edu/climate_site/climate.htm

Some rainfall has occurred across the state in the last two weeks. Most rainfall has been associated with thunderstorms and been relatively isolated in nature. No rainfalls have been heavy enough to alleviate problems because of the longer term dryness across the state. Most rainfalls have been only enough to hold off worsening of the drought situation. We have seen some worsening of the drought situation according to the US Drought Monitor as areas especially west of the river have received little rainfall.

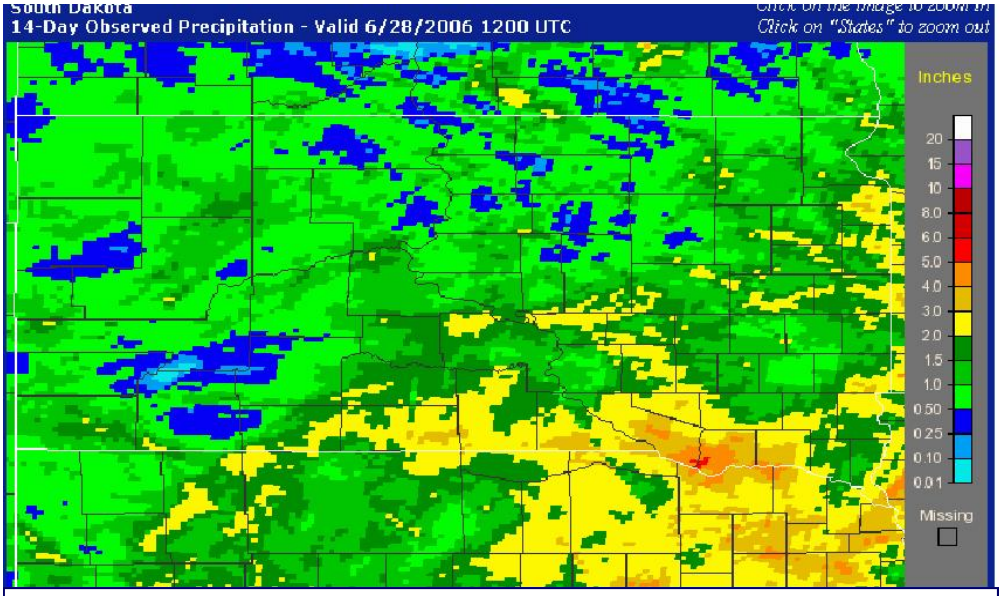

Fig. 1 Radar estimated precipitation from 15 June to 28 June 2006. Color bar is on the right side of the image. http://www.srh.noaa.gov/rfcshare/precip_analysis_new.php

Current Conditions

Rainfall over the last two weeks has been heaviest in the far southeast part of the state. Total rainfalls have generally been less than 1.5" in the northwest half of the state with some areas over 2" in the southeast (Fig. 1). There have been several hail damage reports along with these storms around Watertown, south of Eureka and in the southeast with the heavier storms.

While these rainfalls are a welcome change and have helped limit worsening of the drought situation, it has not been significant enough to overcome the deficits during the winter and spring. Nearly the whole state is below average precipitation for the year. The worst locations in the central part of the state are over 6" below average since January 1. For comparison, the observed precipitation in McIntosh, Timber Lake and Mobridge has been less than 4" during the calendar year. Note that some of the areas that did receive some rainfall are still well below average for the year.

The US Drought Monitor has reflected these continuing impacts by expanding the D3 (Extreme Drought) area and the surrounding D2 and D1 areas because of worsening range conditions and small grain conditions (Fig. 2).

Agricultural Conditions

According to the South Dakota Agricultural Statistics Service, winter wheat conditions are 61% poor or very poor. Other small grains are not far behind (spring wheat 49%, barley 36% and oats 45%). Alfalfa is listed as 39% poor to very poor and rangeland conditions as 40% poor to very poor. Corn and soybeans are not showing problems, yet, because they are in the wetter areas of the state and their most potentially stressful period is not until July and August.

Water supplies for continue to become tighter with 41% of producers indicating very short to short water supplies. Feed supplies are listed at 38% short

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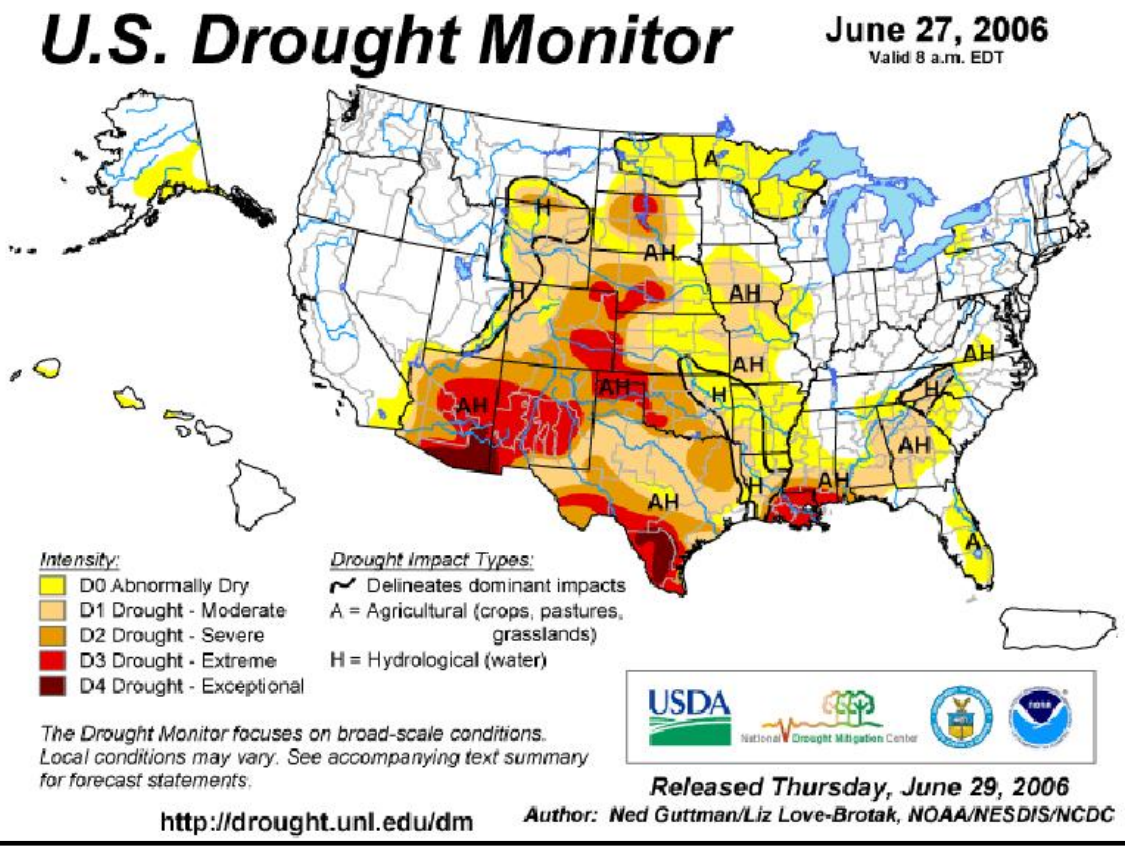

Fig. 2 US Drought Monitor for 27 June 2006

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to very short.

More detailed information can be found in the following link.

http://www.nass.usda.gov/Statistics_by_State/South_Dakota/Publications/Crop_Progress_&_Condition/index.asp

Outlook

As we enter July, we typically expect precipitation chances to be reduced as June is usually the wettest month of the year. Current indications lean toward chances of warmer than average temperatures across the state. Drier surface conditions will help temperatures stay warmer.

Precipitation chances into July are not well defined. But current model projections don't hold out much hope for a change to wetter conditions. Chances for precipitation do occur. But widespread precipitation needed to alleviate drought impacts seems less likely.

- Forecasts can be found at: http://www.weather.gov
- Precipitation averages: http://climate.sdstate.edu/climate_site/climate_page.htm
- Links to current outlooks: http://www.cpc.ncep.noaa.gov/

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limits. These results show that the removal capacity of both cadmium and lead by limestone are significantly higher than for arsenic.

Additional materials characterization and batch and column experiments were completed during this project to further characterize the starting materials and metals removal capacity of manufactured limestone-based granules. Ideas for future research include adding different additives to the manufactured granules to test metals removal enhancement, and performing additional batch and column studies using naturally occurring ground water spiked with metals for engineering and scale-up design of an on-site treatment unit.

Big Sioux Water Festival

By Ross Vander Vorste

The 14th annual Big Sioux Water Festival was held on May 18, 2006. This event was held on the South Dakota State University Campus. Over 900 fourth graders from the surrounding area attended the day-long venue. The students were guided around campus by volunteer chaperons. They were able to attend over 20 hands-on activities related to water and wildlife.

Students learned about how water was used in a gold panning demonstration. The kids were allowed to keep their "treasures."

Dragonfly Pond, Gooey Garbage, Gold Panning, and Under the Microscope were just some of the exhibits that helped inform students about the importance of water and wildlife conservation. Students were able to collect and examine stream invertebrates, test water transparency using Secchi Disks, track non-point source pollution and construct terrariums. The fourth graders were able to get their hands dirty at a variety of other activities.

Presentations were also given on recycling, wildlife migration, identifying wetland plants and waterfowl. Sammy Soil Saver, Mother Earth, and Wendy Water Drop cruised the exhibit halls, quizzing the students and rewarding them with prizes.

Meetings of Interest

June 2006

22-23: Board of Water and Natural Resources meeting

July 2006

12-13: Water Management Board meeting

13: South Dakota Lakes and Streams

20: Board of Minerals and Environment meeting

31: SD State Emergency Response Commission meeting

31: Board of Operator Certification meeting

August 2006

16-17: Board of Minerals and Environment meeting

27 - Sept. 2: The 5th International Conference on Reservoir Limnology and Water Quality.

September 2006

20 (or 27): Pierre Water Festival

21: Aberdeen Water Festival

28-29: SD Board of Water and Natural Resources

Limnology 101

The weekend of June 3-4 was an active one for lake lovers. David German (South Dakota Water Resources Institute) and Dennis Skadsen (Day Conservation District) presented a lake water quality workshop to eight participants at the NeSoDak Camp on Enemy Swim Lake.

The idea behind the workshop stemmed from the fact that most water quality events like Water Festivals are usually targeted towards children. That is why German decided to teach a lake water quality class to adults. "Adults are the ones who build houses and septic systems on the beaches of our lakes. They and their families can directly make an impact on the water quality of their lake," he said.

Another reason for doing the workshop was the idea of "teaching the teachers." German said, "Teaching these adults about water quality and providing them with useful information encourages

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Clear Lake resident, Kirk Hansen, presents lake water quality information at the Clear Lake Association's Annual Meeting.

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them to teach others in their home community how their behaviors affect the lake." A PowerPoint presentation was available for participants to help encourage them to share what they learned at the workshop. Kirk Hansen, a Clear Lake resident in Marshall County, was one of the participants that has already shared his new-found knowledge. Hansen made a presentation about the principles he learned at the workshop during the Clear Lake Association's Annual Meeting.

To help reinforce the water quality concepts taught and keep the class lively, German and Skadsen helped the participants play "The Lake Game." This true-to-life game allowed everyone to see how the decisions he or she makes from where to dig sewage systems to rural runoff affect lake systems. Several participants asked for a version of The Lake Game be made specifically for the lake they live on. This game will assist in helping make the lake water conservation and preservation message more vivid. The game is designed for children to play, and is an integral part of the "Lakes are Cool" events, which are held during the summer at Enemy Swim Lake. "The game appeals to adults and children, which allows the workshop participants to return to their lakes and have a community "game night" where they could demonstrate and play the lake game." German said.

German and Skadsen also set up microscopes and slides with samples of Enemy Swim Lake water. German has been to many Water Festivals where he sets up the microscopes for kids to view the lake water. He said, "The adults acted just like kids when looking at different lake critters under the scope. Many of them had never seen what lived in the lake they live on."

Everyone enjoyed eating "mercury" cookies (a lake biomagnification demonstration). The biomagnification demonstration helped participants visualize how mercury can be "transported" through a lake system and how quickly the amount of mercury contained in the zooplankton that are eaten by little fishes that are eaten by bigger fishes that get eaten by humans accumulates.

The group also made their own Secchi discs to monitor the transparency of their own lakes. German said, "A Secchi disc is a simple way to monitor the water quality of a lake and will allow these folks to take an active part in monitoring their lake."

The success of this first workshop has encouraged German and Skadsen to ask and receive an extension on this grant, which will allow them to teach the class again in the fall. More information will be in future newsletters or you can contact the SD WRI office by phone at (605) 688-4910 or email at sdsu.wri@sdstate.edu.

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Timetable	
Abstract Deadline	July 15, 2006
Notification of Acceptance	August 1, 2006
Early-Bird Registration Deadline	October 1, 2006

Development District, and the Water & Environmental Engineering Research Center and the Water Resources Institute at South Dakota State University.

*Conference Website

*Call for Presentations Form

*Conference Brochure