

Salinity Mitigation Research

Investigating the use of clays to remove salt from groundwater

Naturally occurring groundwater can contain naturally occurring water-soluble salts. Potash (which is primarily a salt, potassium chloride (KCl)) is water soluble and any water (which is heavily used in industrial processes, including mining) in contact with the potash becomes salty or “brackish”. Brackish water can negatively affect fresh surface water, soil quality and can impact fresh groundwater aquifers. Saskatchewan’s potash industry is interested in investigating novel ways to mitigate salinity issues. Researchers at the University of Saskatchewan proposed **the Salinity Mitigation Research** project, a project to assess whether various clays can be used to reduce the amount of salt in water.

The primary chemical process being used in this research is **adsorption**. Adsorption is when molecules of one substance are attracted to and attach to the surface of another substance. In contrast, absorption is when the molecules of one substance are taken into the internal structure of another substance. In this project, the researchers proposed to develop clay-based adsorbents to simultaneously remove sodium and chloride from potash brine impacted water, investigate if used clay-based adsorbents can be used to treat hard-water and metal contaminated water, and assess locally available geochemical and microbial (bacteria) in groundwater. The project also proposed to use synchrotron technologies to be able to see the interactions of the brackish water solutions, the clay-based adsorbents, metals and microbial populations.

Testing occurred in the laboratories at the University of Saskatchewan and images of the adsorption mechanisms were produced at the Canadian Light Source. The researchers found natural and engineered clay-based adsorbents were successful in pulling sodium ions out of salinized groundwater. Using a combination of different clay-based adsorbents, the researchers found that they could capture both sodium and chloride ions. In the process of this study, the researchers developed a new engineered adsorbent, which they called mayenite. Mayenite was shown to have the ability to be regenerated. The application of heat effectively “reset” the mayenite, allowing this new engineered adsorbent to be reused multiple times between “heat resets”. The researchers also successfully tested pelletized mayenite using a laboratory column filtration system. The researchers made several recommendations around how the mayenite may be used in water filtration systems, including use in possible uses in filtration systems and tailings management systems. The researchers also investigated naturally occurring microbial populations in salinized groundwater, concluding that there may be a possibility of using one specific type of bacteria for copper removal. This project also supported the development of three new high qualified people (three M.Sc. students) and a post-doctoral fellow.

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University of Saskatchewan, Dec 2014 – Jun 2018

Project Cost:	\$361k
IMII:	\$144k
NSERC:	\$113k
Mitacs:	\$104k