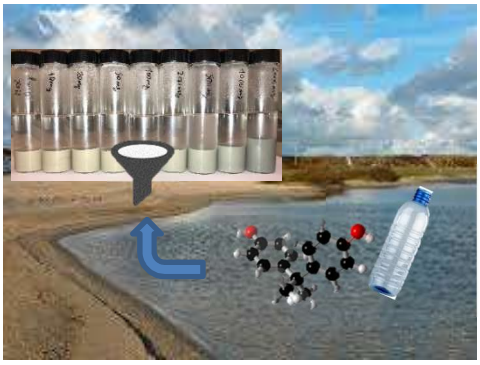
INDUSTRIAL PILOT PROJECT

Removal of BPA from drinking water: How to utilize neutrons to optimize water purification filters

THE INDUSTRIAL CHALLENGE

Water purification and filtration is one of the essential tools to maintaining public health. Due to the use of plastic products, contaminants like bisphenol A (BPA) are increasingly present in the natural environment. The water treatment plants that filter and clean our household water have to be able to remove BPA in an efficient way. Clay and sand are potent and easily available filter materials for water purification. By investigating how BPA behaves at the atomic scale in the filter, we can enable engineers to improve the filters for more efficient water treatment methods.

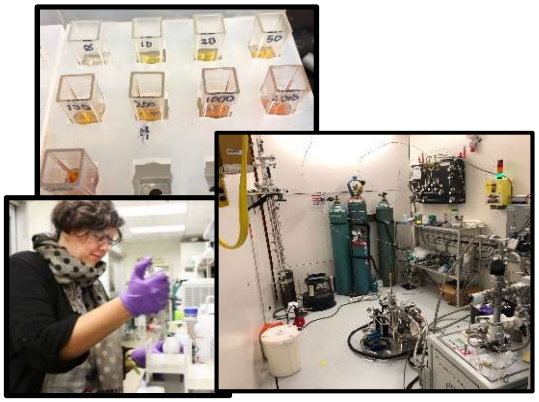


WHY USING A LARGE SCALE FACILITY

Neutrons are nondestructive and they can penetrate materials such as sand and clay more deeply than similar laboratory research methods. The sensitivity of neutrons to hydrogen makes neutron scattering techniques ideal for studies involving water, especially for studying water in structures that are opaque. Laboratory based spectroscopy sensitive to water (FT-IR, RAMAN) cannot show what is inside the sand/clay but only on the outer surface.

HOW THE WORK WAS DONE

The samples were prepared in the laboratories of the European Spallation Source (ESS) in Lund using well-defined synthetic clay and sand. We were awarded beamtime twice to record neutron vibrational spectra at the VISION instrument at ORNL's Spallation Neutron Source (SNS) in Oakridge, U.S. The BPA concentrations deposited in the clay were pre-determined using the UV/VIS spectroscopy setup in the SNS user laboratories and at ESS. Staff from both Sweden Water Research AB (SWR) and ESS collaborated in the laboratory method development for BPA analysis.



THE RESULTS AND EXPECTED IMPACT

The performed neutron scattering experiments showed that the water dynamics on clay and sand filter materials changes on the atomic scale changes when increasing amounts of BPA cover their surfaces. Consequently, the properties of the filter materials are changing during its use which has an impact on waste water purification using clay and sand filters. As the research on BPA and its effect on the environment is becoming increasingly important to society, this type of work receives more and more attention. Through this collaboration between SWR and ESS, we were able to demonstrate the usefulness of neutrons for applied science in an area not yet commonly explored by industry using neutrons. It has also become clear that at least for small industry, such an endeavor is easier pursued in close collaboration with researchers specialized in neutron scattering.

Contacts: Jesper König – Sweden Water Research, jesper.konig@swrab.se
Monika Hartl – European Spallation Source, monika.hartl@esss.se

Vinnova's project No: 2018-03264 **Duration:** October 2018 – August 2019

Funded by Sweden's Innovation Agency, Vinnova, in order to build competence and capacity regarding industrial utilisation of large-scale research infrastructures such as MAX IV and ESS.