In-Person

References:

MDPI Energies Student Poster Award:

No, do not submit my presenation for the student posters award.

Country:

USA

Acceptance of the Terms & Conditions:

Click here to agree

Energy Transition Focused Abstracts:

Poster / 829

Laboratory scale demonstration of asbestos mobility in sandy aquifer systems

Author: Leonardo Magherini[1]

Co-authors: Chiara Avataneo ; Silvana Capella ; Manuela Lasagna ; Carlo Bianco [2]; Elena Belluso ; Domenico De Luca ; Rajandrea Sethi [1]

[1] *Politecnico di Torino*

[2] *Politecnico di Torino - DIATI*

Corresponding Authors: domenico.deluca@unito.it, silvana.capella@unito.it, carlo.bianco@polito.it, c.avataneo@unito.it, leonardo.magherini@polito.it, elena.belluso@unito.it, manuela.lasagna@unito.it, rajandrea.sethi@polito.it

Asbestos is a well-known and regulated air pollutant and it is indeed classified as a carcinogenic compound of the first group. However, several studies recently reported asbestos presence also in fresh water sources, such as lakes, rivers, groundwater and drinking water. As far as human exposure, two main pathways can be identified for waterborne asbestos: (i) inhalation due to water evaporation and subsequent fibre dispersion into air; (ii) ingestion mainly via drinking water. For the first case, the concentration limits (number per litre of longer than 5 µm fibres) established for air must be respected, i.e. 100 f/L at workplaces (U.S. Occupational Safety and Health Administration) and 1 f/L in outdoor environments (World Health Organization). As for oral exposure, the effects of asbestos ingestion on human health are still not well known; however, the U.S-Environmental Protection Agency established a precautionary concentration limit for longer than 10 µm fibres in drinking water of 7·10⁶ f/L.
Focussing on groundwater contamination, asbestos fibres can typically be found in areas where water flows through aquifers containing Naturally Occurring Asbestos or in the proximity of mines and mine tailing deposits. The abovementioned contamination scenarios can represent a severe environmental and sanitary issue due to the potential capability of asbestos to migrate through aquifer systems. However, until now asbestos has been considered substantially immobile in groundwater since its shape and surface charge are expected to result in irreversible filtration of the fibres upon release into the aquifer. Therefore, no studies have investigated in depth the mechanisms governing the asbestos subsurface mobility so far.
This laboratory scale work studied the transport of crocidolite, a negative charged amphibole asbestos, through quartz sandy aquifers. Two sets of column tests were performed varying the concentration of the injected asbestos suspension, the sand grain size distribution and the water pH. The asbestos concentration in water was measured at the column inlet and outlet using a UV-vis spectrophotometer and the fibre number, size and shape were characterized through SEM-EDS analysis. The results demonstrated that crocidolite asbestos is not actually immobile and can potentially flow through sandy porous media. As expected, fibre retention was higher in the finer sand, even if the grain size influence was found to be more pronounced when increasing asbestos concentration in the injected suspension. Interestingly, the study showed that asbestos deposition is not completely irreversible, since a fraction of the filtered fibres was remobilized after the column was flushed with

high pH water. As for morphological characterization, small fibres proved more mobile than the long ones: several fibres with length > 5 μm (carcinogenic when respired) were collected at the column outlet, whereas most of the fibres longer than 10 μm were filtered out by the porous medium. These results suggest that the air dispersion of waterborne fibres is expected to be the most likely and impacting scenario. Future studies should therefore aim at confirming the effective crocidolite mobility also in real environments.

Participation:

In-Person

References:

MDPI Energies Student Poster Award:

Yes, I would like to submit this presentation into the student poster award.

Country:

Italy

Acceptance of the Terms & Conditions:

Click here to agree

Energy Transition Focused Abstracts:

830

Wettability of Supercritical Carbon Dioxide, Brine, and Shale as a Function of Pressure

Authors: Deepak Tapriyal[1]; Foad Haeri[1]; Dustin Crandall[2]; Angela Goodman[1]

[1] *US Dept of Energy - National Energy Technology Laboratory*

[2] *US Department of Energy - National Energy Technology Laboratory*

Corresponding Authors: angela.goodman@netl.doe.gov, foad.haeri@netl.doe.gov, dustin.crandall@netl.doe.gov, deepak.tapriyal@netl.doe.gov

Injection of large amounts of carbon dioxide (CO2) into subsurface reservoirs for geologic carbon storage will increase the pressure in these reservoirs and surrounding zones. Due to buoyancy, the CO2 will gradually migrate upwards towards low permeability sealing formations (e.g., shales) above more porous injection zones. These seals must restrict further vertical movement of the CO2 to groundwater and the surface for geologic carbon storage to be a viable method of substantially reducing anthropogenic greenhouse gas emissions. Using a unique precision experimental device, we have examined the change of CO2/brine/shale contact angles under representative carbon storage scenarios. Shale samples were submerged in brine, system temperature was maintained at 40℃ or 100℃, and pressure of the system was increased from 8.3 MPa to 62 MPa. After equilibration, small bubbles of supercritical CO2 (diameters ranging from 200 to 2200 microns) were placed below the shale samples submerged in brine and the contact angle of the CO2 was measured. No significant alteration of the contact angles was observed due to changes in temperature or pressure, though smaller bubbles did tend to have slightly higher contact angles, as has been previously reported (Haeri et al 2021). There was no observed change of the wettability from water wetting to CO2 wetting, which bodes well for sustainable CO2 storage in geologic carbon storage reservoirs as the pressure increases from large volume injections.

Participation:

Online

References: