Chromate reduction by sulfate green rust (GR_{SO4}) and sulfidized zero valent iron (sZVI) in packed sand columns

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Chromate, Cr(VI), contamination in soil and groundwater is a frequent occurrence and poses a serious threat to human and environmental health. In the last two decades, clean-up strategies have mainly focused on the use of zero valent iron (ZVI) for *in situ* reduction of Cr(VI) to immobile, and less toxic Cr(III). Although ZVI particles are highly reactive at first, they are also quickly passivated due to reaction with water and hence exhibit short longevity. Alternative reactants, with similarly high Cr(VI) reduction capacities but possibly increased longevity, include sulfidized ZVI (sZVI) and sulfate green rust (GR_{SO4}). However, so far, only little is known about their reduction efficiencies in porous matrices such as soils and sediments where these reactants would ultimately be applied to.

Here, we compared the reduction of Cr(VI) by sZVI and GR_{SO4} in packed quartz sand columns (grain-Ø: 0.1-0.3 mm). sZVI and GR_{SO4} were synthesised and then each wet-packed with the sand in the column (length: 11 cm, ID: 1.4 cm) to yield Fe loadings of 46 mmol (i.e., Fe^0 or Fe^{2+}). After, a Cr(VI) solution was injected (250 µM, pH 7, flow velocity 5.4 m/day) and the effluent Cr(VI) concentration was monitored *in situ* using a flow through cell connected to a UV-vis spectrophotometer.

Initial results indicate that GR_{SO4} is a more efficient reductant compared to sZVI, shown by almost twice the amount of Cr(VI) retained in the GR_{SO4} column compared to the sZVI column, and this despite sZVI having a three times larger electron pool. Moreover, the duration of the sulfidation treatment during sZVI synthesis did not significantly affect the Cr(VI) retention capacity. Further investigations regarding impacts of varying pH and flow rates and the use of a sZVI dispersant on Cr(VI) retention are currently ongoing, including characterization of the Fe/Cr minerals formed inside the column by X-ray diffraction.