

Evaluating the behaviour and long-term stability of layered double hydroxides in groundwater

Virginia Alonso de Linaje^{a,*}, Marco Mangayayam^b, Adrian Schiefler^c, Nicolas Bovet^b, Rubén Espinosa^a, and Kim N. Dalby^b

^aAECOM Environment, Spain

^bNano-Science Center, Department of Chemistry, University of Copenhagen, Denmark

^cCapital Region of Denmark, Kongens Vænge 2, 3400 Hillerød, Denmark

(*Corresponding author, Email address: virginia.alonsodelinaje@aecom.com)

In recent years, the use of nanomaterials for *in situ* groundwater treatment has gained more attention because more and more water sources are becoming contaminated. However, there is some concern about the long-term effect of nanomaterials on human health and ecological risks associated with their implementation as remediation reagents [1]. In principal, any change in the nanoparticle structure might jeopardize their adsorption/sorption capacity for trapping contaminants. Therefore, it is important to determine their structure evolution and long-term stability under groundwater conditions.

For the past few decades, a wide variety of clays and organo-clays have been used as nano-sized sorbents for chlorinated hydrocarbons, metals, and pesticides in water. Layered double hydroxides, also known as hydrotalcite-like compounds, are a family of synthetic or natural clays formed by two different metal cations (M^{III}/M^{II}) in the main layer and anionic species in the interlayer [2,3]. Their high anionic exchange capacity enables the exchange of the interlayer anions with organic species (e.g., surfactants).

In this study we evaluate the long-term stability of Mg/Al layered double hydroxides structure over time, when exposed to groundwater. Both inorganic and organic hydrotalcites with Mg/Al ratio of 3:1 were synthesized by incorporating CO_3^{2-} , and dodecyl sulfate ($C_{12}H_{25}SO_4$) into the interlayer via coprecipitation, and under a constant pH. Dried samples were set in a tray of dialysis bags and lowered into two different monitoring wells at the Innovation Garage, Denmark. Groundwater exposed samples were collected and dried at different times over 4 months. Changes in hydrotalcite surface and bulk crystal structure were probed using powder X-ray diffraction and X-ray photoelectron spectroscopy.

Preliminary results showed that after 2 months inorganic and organic hydrotalcites preserve the same interlayer anions as their precursors, but we observe changes in the Mg/Al ratio and Al/interlayer anion ratio.

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