

Preliminary results of sorption behaviors of Mn(II) on the surface of naturally common oxides

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Manganese, an abundant and ubiquitous element in the environment, plays a key role in controlling the fate and transport of various inorganic and organic substances by participating in complex (bio)geochemical processes. During the abiotic and/or biotic geochemical processes of Mn at naturally common mineral-water interfaces, the formation and the phase transformation of numerous types of Mn (oxyhydr)oxides may prevail. For a better understanding of abiotic Mn(II) oxidation and diverse Mn (oxyhydr)oxides formation, it is important to understand Mn(II) sorption on the surface of common natural sorbents, which is the basis and the key process of abiotic heterogeneous Mn(II) oxidation at the mineral-water interfaces. This study examines the sorption behaviors of Mn(II) to common natural oxide sorbents.

Batch experiments of Mn(II) sorption to different types of oxides are conducted at room temperature under various aqueous conditions. Reagent grade oxide sorbents are purchased characterized by XRD, BET, SEM, and XRF. Typical sorption edges and sorption isotherms of Mn(II) to the sorbents are obtained by varying solution pH, and sorbate/sorbent ratio in a carbonate- and oxygen-free glove box. Carbonate- and oxygen-free system is strictly controlled by preparing 10 mM NaNO₃ electrolyte which is purged with N₂, acidified to pH ~ 4, and then adjusted to a desired pH value with carbonate-free NaOH in a glove box with an additional oxygen-trap. In addition, the effects of carbonate on Mn(II) sorption are assessed by varying total dissolved carbonate concentration. Under strictly carbonate- and oxygen-free conditions, Mn(II) adsorption shows typical cation-type sorption edges and follows the Langmuir-type isotherms. By contrast, Mn(II) precipitates as MnCO₃ at elevated carbonate concentrations on the surface of the oxide sorbents.