Attenuated total reflection-infrared spectroscopy: a tool of choice for investigation of the sorption of oxyanions

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Attenuated Total Reflection-Infrared spectroscopy (ATR-IR) is a fast-expanding spectral techniques to *in situ* studies of the solid/solution interfaces. Several optical materials can be used as ATR crystal, but the range of probed frequency is always limited above around 700 cm^{-1}). The observation of sorbed heavy metals is therefore not possible since absorption bands of surface complexes would take place below this limit, contrary to most of oxyanions due to their polyatomic structure [1]. The first studies showed the adsorption of model ions (sulfate, carbonate) onto metal oxides, then several pollutants have been investigated (AsO_4^{3-}, SeO_4^{2-},…), along with other mechanisms, as ion exchange, have been followed.

Examples amongst our recent results are presented, as the study of sorption of molybdate and tungstate ions onto hematite. Thus, the use of ATR-IR to characterize surface complexes with tungstate ions is presented for the first time to the best of our knowledge. From the comparison of spectra of solution species as monomeric and polymeric geometries, the inner-sphere behaviour of tungstate has been deduced. A first try with perrhenate ions has been performed, confirming the formation of outer-sphere complexes.

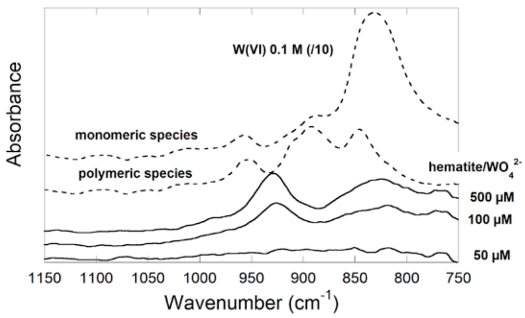

Figure 1. Spectra of tungstate solutions and adsorbed tungstate ions at pH 8.4.

[1] Lefèvre (2004) Adv. Colloid Interface Sci. **109**, 107-123.

Stable soil carbon decomposition is more sensitive to temperature. Evidence from long term bare fallow experiments

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The impact of climate change on the stability of soil organic carbon (SOC) remains a major source of uncertainty in predicting future changes in atmospheric CO_2 levels. One unsettled question is whether the mineralization response to temperature is the same for labile and stable SOC pools. Long-term (>25 years) bare fallow experiments (LTBF) in which the soil is kept free of any vegetation, represent a unique research platform to examine this issue as with increasing duration of the treatment, the proportion of stable SOC relative to total SOC increases.

We used soils from LTBF experiments situated at Askov (Denmark), Grignon (France), Versailles (France) and Ultuna (Sweden). We used archived soils sampled at the start of the experiments and after 25, 50, 80 and 52 years of bare fallow, respectively, when the soils had became enriched in stable SOC. Samples were incubated at 4, 12, 30 and 35 °C and evolved CO_2 was monitored. We calculated the activation energy of SOC after the same amount of respired C at the different temperatures. The activation energy was always higher for samples more concentrated in stable C, implying a higher temperature sensitivity of stable C compared to more labile C. Hence, assuming the same temperature sensitivity for different soil carbon pools in simulation models appears inappropriate.

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