Spectroscopic study of Eu(III)-fulvate complexation: Influence of pH and fulvic acid concentration

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Natural organic matter (NOM) affects the fate of radionuclides in the environment, either by supporting their mobility in water, or by limiting their migration in soils and sediments. A better knowledge of radionuclides-NOM interactions is needed to better assess nuclear facilities. Eu(III) was studied as a chemical analog for actinides(III). Batch experiments were done at different Eu(III) concentrations and pH, using Suwannee River fulvic acid (SRFA) concentrations up to 1 g/L. Eu(III) speciation was investigated by time-resolved luminescence spectroscopy (TRLS). Two different luminescence behaviours were observed (Fig. 1). The first part of the isotherms at low C(SRFA) is showing the typical luminescence evolution of Eu(III) complexed by humic substances [1], At higher concentration (C > 100 mg_{SRFA}/L at pH 4, C > 30 mg_{SRFA}/L at pH 6), a second luminescence mode that depends of pH is detected and could correspond to a different spatial organization of the Eu complex. Generic data from NICA-Donnan model [2] were used to predict Eu(III) speciation, and further adjusted to experimental data.

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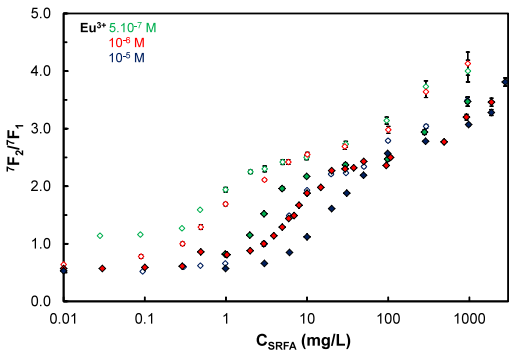

Figure 1: Evolution of $^5D_0 \rightarrow {}^7F_2/{}^5D_0 \rightarrow {}^7F_1$ ratio depending on C(SRFA) at I = 0.1 M, pH 4 (open symbols) and pH 6 (filled symbols).

[1] Brevet *et al* (2009) *Spectrochimica Acta A* **74**, 446-453 [2] Janot *et al* (2013) *Geochimica Cosmochimica Acta* **123**, 35-54