

## Chromium(III) and bismuth(III) complexation to organic matter: EXAFS spectroscopy and equilibrium modelling

J.P. GUSTAFSSON<sup>1\*</sup>, A.G. OROMIEH<sup>1</sup>, C. SJÖSTEDT<sup>2</sup>,  
I. PERSSON<sup>1</sup> AND D.B. KLEJA<sup>1,3</sup>

<sup>1</sup>Swedish University of Agricultural Sciences, Uppsala, Sweden; \*(correspondence: jon-petter.gustafsson@slu.se)

<sup>2</sup>Department of Chemistry, KTH Royal Institute of Technology, Stockholm, Sweden

<sup>3</sup>Swedish Geotechnical Institute, Stockholm, Sweden; Dan.Berggren.(Kleja@swedgeo.se)

The complexation of chromium(III) and bismuth(III) to mor layer material was investigated. Characterization of the products was made at MAX-Lab, Lund, Sweden, using Cr *K*-edge and Bi *L*<sub>3</sub>-edge EXAFS spectroscopy.

The EXAFS results showed a predominance of monomeric organic complexes for chromium(III). The sorption of chromium(III) was pH-dependent. Chromium(III) complexation was found to be very slow at pH < 4, and equilibration times of three months or longer were required to reach equilibrium. For bismuth(III), complexation was quicker and found to be very strong, with more than 94 % bound at pH 1.2 also at a high bismuth(III) loading. EXAFS spectroscopy showed that the bound bismuth(III) ion is strongly distorted and interacts with a second bismuth(III) ion at ~4 Å. The complexation of bismuth(III) remained essentially unchanged even in the presence of a potent competitor such as iron(III).

The results from the spectroscopic investigation and from the quantitative solution data were used to calibrate new and improved complexation models for the Stockholm Humic (SHM) and the NICA-Donnan models. Similarities and differences in the organic complexation of the four trivalent metals chromium(III), bismuth(III), iron(III) and aluminium(III) will be discussed.

## The study of Hg transformation in the Au recovery plant tailing area using thermal release technique with atomic absorption detection

M.A. GUSTAYTIS<sup>1\*</sup>, O.V. SHUVAEVA<sup>2</sup>,  
I.N. MYAGKAYA<sup>1</sup> AND E.V. LAZAREVA<sup>1</sup>.

<sup>1</sup>Institute of Geology and Mineralogy SB RAS, Koptyug Pr. 3, Novosibirsk 630090, Russia (\*goustaitis\_m@mail.ru)

<sup>2</sup>Institute of Inorganic chemistry SB RAS, Acad. Lavrentiev Pr., 3, Novosibirsk, 630090, Russia

It is known that gold mining is one of the most powerful sources of mercury emission into environment. A present investigation was focuses on the Ursk tailings located in Kemerovo region (southwestern Siberia, Russia), that contains waste material produced by the cyanidation of the primary gold polymetallic ores and ores of the oxidation zone with elevated level of mercury and consisting of sand, sand-silt, silt and organic (peat mounds and buried peat).

As a result of the study it has been shown that in tailing shed wastes matereals mercury is presented as HgX<sub>2</sub>, HgS and methylmercury at the predominance of HgCH<sub>3</sub><sup>+</sup> and Hg<sup>2+</sup>, and also as impurities in pyrite and barite. Herewith in sand matter mercury is contained as oxidizing species (49-54 µg/g) and CH<sub>3</sub>HgX (9-60 µg/g); in sand-silt - as HgX<sub>2</sub> (~15 µg/g), CH<sub>3</sub>HgX (~15 µg/g) and HgS (~3 µg/g); in silt - as oxidized species (12-43 µg/g), merthylmercury (9-21 µg/g) and HgS (3-13 µg/g). In organic matter close to waste methylmercury prevails (up 25 to 2 µg/g), but in organic matter of perennially wet zone mercury exists as cinnabar and mercury selenide (Hg<sub>total</sub>=2350 g/t).

It can be assumed that Hg<sup>2+</sup>-compounds are formed under the interaction of the shed wastes material with the components of the environment while methylmercury appears due to the presence of organic carbon in the pore solution as in the solid its concentration is negligible. As for organic carbon it may originate from the substances of peat mounds and buried peat. Mercury content in pyrite and barite doesn't generally exceed 10% of the total one.

On the base of the results of the present study and the published data as well the scheme of mercury transformation was proposed.

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