Geophysical Research Abstracts
Vol. 14, EGU2012-14108, 2012
EGU General Assembly 2012

Effect of Organic Matter on the Parameters of the Selective Adsorption of Cobalt and Zinc by Soils and Their Clay Fractions

I.V. Kochetkov and V.S. Anisimov

All-Russian Institute of Agricultural Radiology and Agroecology RAAS, sh. Kievskoe 109 km, Obninsk, Kaluga oblast, 249032, Russia

Effect of Organic Matter on the Parameters of the Selective Adsorption of Cobalt and Zinc by Soils and Their Clay Fractions
I.V. Kochetkov, V.S. Anisimov
All-Russian Institute of Agricultural Radiology and Agroecology RAAS, sh. Kievskoe 109 km, Obninsk, Kaluga oblast, 249032, Russia
E-mail: ikochetkoff@gmail.com, vsanisimov@list.ru
The aim of this work was to study the effect of organic matter from different soils on the ion-exchange adsorption of Co(II) and Zn, which have appreciably different biogeochemical behaviors.
The adsorption and ion-exchange behavior of Co(II) and Zn in the soil-equilibrium solution system was studied for different types and varieties of native soils and their clay fractions before and after mild oxidation with H_2O_2 to remove the organic carbon. The parameters of the ion-exchange adsorption and the selectivity coefficients of the (Co(II), Zn)/Ca ion exchange for describing the relationship between the dissolved and adsorbed forms of the metals were determined using models: empirical Langmuir and Freundlich and the model based on the acting mass law. It was found that the soil organic matter played an important role in the selectivity of the ion-exchange adsorption of Co(II) and Zn by the soils and their clay fractions. This was confirmed by an abrupt decrease (to almost 1) of the selectivity coefficients of the Co2+/Ca2+ and Zn2+/Ca2+ exchange after the treatment of the clay fraction with hydrogen peroxide.
Studies were conducted on two soddy-podzolic soils with different textures (loamy sandy and loamy ones) sampled from the plow horizon of agricultural lands and a leached chernozem. The main parameters of the soils were determined using the conventional procedures.
A higher selectivity of the Co2+/Ca2+ and Zn2+/Ca2+ ion exchange was revealed for the chernozem and the loamy soddy-podzolic soil compared to the loamy sandy soddy-podzolic soil. The comparative analysis of the selectivity coefficients for the Co and Zn ion-exchange adsorption by native soils and their clay fractions showed that the values of Ks(Me/Ca) for the clay fractions exceeded the corresponding values for the native soils by 1.5-27 times at the minimum portions of soil exchange complex (SEC) saturated with Co2+ and Zn2+ ions. This pointed to the important content of the physical clay (and especially the clay) fractions for the selectivity of the ion exchange.
The capacity of the SEC affected the adsorption of Co by the soils. The coefficients of the determination between the CEC and potential sorption capacity (PSC) were very high for the soils (r2 = 0.99) and significantly lower for the clay fractions (r2 = 0.70). A relationship between the adsorption of Zn and the SEC capacity was detected only for the soils (r2 = 0.99) but not for their clay fractions (r2 = 0.03). Thus, this factor was not decisive for the selectivity of the Co2+/Ca2+ and Zn2+/Ca2+ ion exchange.
It was found that a significant decrease in the selectivity coefficients of the Co2+/Ca2+ and Zn2+/Ca2+ ion exchange was observed after the treatment of the clay fraction with H_2O_2, which degraded most of the organic matter: the Kh and Kl values decreased by 3 and 300 times, respectively. This argued for the prevailing role of organic matter in the selectivity of the Co and Zn ion-exchange adsorption by the soils and their clay fractions.