Kinetics of cadmium fixation onto bone meal measured by Isotopic Dilution

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Introduction

Over the past 15 years, extensive research has been carried out to identify new and economically priced sorbents for heavy metal removal from contaminated sites. Bonemeal (calcium hydroxyapatite) has been suggested as an effective low cost amendment to remediate heavy metal contaminated soil by decreasing metal bioavailabilty.

Understanding of the kinetics and mechanisms of metal adsorption onto mineral surfaces is fundamental if accurate predictions are to be made about metal fate and mobility.

Although still unclear, it is believed that due to the heterogeneous properties of bone meal, the mechanisms of metal sorption and phosphate formation comprises physical sorption, ion exchange and chemisorption (nucleation, precipitation).

Objectives of the study

The present study was undertaken to further elucidate the adsorption mechanism of cadmium onto bone meal and to investigate the effect of time on the lability of cadmium and the reversibility of the adsorption process.

Experimental section

After characterization of the bone meal by X-ray diffraction analysis and scanning electron microscopy, the adsorption of cadmium onto bonemeal was investigated in batch experiments using isotopic dilution techniques.

A binary experimental set up at different equilibration periods was used. The isotope was introduce with a specific loading in one experimental subset to measure the total adsorbed Cd, while it was introduce at the end of the reaction time in the other subset to measure the labile adsorbed Cd (isotopically exchangeable).

Preliminary results and conclusions

Results so far demonstrate instantaneous fixation of Cd as well as time-dependent transfer to non-labile pools. Further studies will examine the reversibility of the adsorption process and the effects of metal competition for surface sites.

Aerosol and sulfur compounds passing over Fukuoka, Japan estimated by cosmic-ray produced radionuclides

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Fokuoka city is located at the north of Kyushu Island, Japan and aerosol and sulfur compounds directly arrived from Asia Continent. The observation of the transfer of aerosol and sulfur compounds is important for the global transfer of their compounds. Cosmic-ray produced radionuclides, such as ^{7}Be (the half-life 53.3 days), and ^{35}S (87.5 days) are produced almost constantly and can trace the behavior of aerosol and sulfur compounds in atmosphere. The purpose of this study is the estimation of amounts of aerosol and sulfur compounds passed over Fukuoka using by the box model of Tanaka and Turekian[1)].

The samples of aerosol and sulfur dioxide in surface air, total deposition, and dry deposition were collected at the roof of a small building every 10 days during one year. The samples of the dry- and total-deposition were dried on a heated plate. ^{7}Be contents were directly determined by γ-ray spectrometry and ^{35}S contents were determined by liquid scintillation counter after its separation by appropriate chemical separation (Osaki et al.[2)]).

The annual average contents of ^{7}Be and ^{32}P in the boundary layer at Fukuoka were 3.16 and 0.088 mBqm^{-3}, respectively and those of sulfur contents of sulfate and sulfur dioxide were 1.25 and 1.01 mmolm^{-3}, respectively and their concentrations of ^{35}S were 61 and 5.5 mBqm^{-3}, respectively. The annual average total depositions of ^{7}Be and ^{32}P were 3700 and 81 mBqm^{-2}d-^{1} and those for dry deposition were 170 and 9.3 mBqm^{-2}d^{-1}, respectively. Those for total deposition and dry deposition of sulfate and sulfur dioxide were also determined.

Above data were applied for the model of Tanaka and Turekian and estimated the concentrations of ^{210}Pb, sulfate and sulfur dioxide in free troposphere on Fukuoka. The calculated concentration of ^{210}Pb in free troposphere was 0.10mBqm^{-3} and those of sulfate and sulfur dioxide were 0.015 and 0.054 mmolm^{-3}, respectively. On the assumption of the average velocity of 36 kmhr^{-1} in free troposphere, 13 Bqs^{-1} of ^{210}Pb, 0.54 mmols^{-1} of sulfur dioxide and 0.15 mmols^{-1} of sulfate aerosol pass through on Fukuoka, Japan.

References

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