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Uranium (VI) absorption by tree bark in a column leaching experiment

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The relationship between uranium (U) and organic matter (OM) has received increasing attention in the fields of mining and remediation. Sediments and wetlands with high (%) OM content can accumulate U from groundwater, and over geological timescales lead to ore formations. The Mulga Rock deposit (13K tonnes of U) near Kalgoorlie, WA is one example in Australia, with many other examples found globally. Despite many occurrences of U-OM deposits, U accumulation within the OM is not yet fully understood. Initial mechanisms may include; U sorption, cation exchange and bonding to carboxyl, phenolic or hydroxyl functional groups. Sorption may later be followed by reduction of the U(VI) to more insoluble U(IV) for more permanent U fixation. The aim of this work was to test the sorption efficiency of U onto solid OM and examine the material for change in U speciation and reduction of the uranyl ion by means of a column experiment. Ground up tree bark (TB) from *Eucalyptus Globulus* was selected for the solid OM fraction due to its well characterized phenolic and carboxylic groups for binding to uranyl-type compounds. A comparison control was comprised of quartz-sand only. For the experiment 80 mg/L U(VI) uranyl nitrate was passed through columns containing either sand, or sand with 20% TB (S-TB) at a rate of 1.25 mL/min. Outflow was monitored using in-situ probes (EC, pH, ORP) to obtain breakthrough curves and fractions collected every 6 minutes for U concentration. Breakthrough curves were more retarded in S-TB columns compared to sand only. U concentration of collected liquid fractions was ~ppb or not detected, implying high U retention by the S-TB. Furthermore, XFM images and XRF analysis revealed that U sorption occurred within the first third of the column. XFM also revealed that sorption occurred to OM in preference to quartz-sand. XAS-XANES analysis (U L3 edge) determined no change in U oxidation state on subsamples for either sand or S-TB. The U:Ca relationship, obtained from XRF on S-TB subsamples, was negative where U had absorbed within the column, and could be suggestive of ion-exchange. These results show that eucalyptus tree bark is a powerful absorbent for soluble uranium nitrate and provides a suitable solid organic material for use in U deposit formation and remediation studies.

Keywords or phrases (comma separated)

Uranium, absorption, organic matter, column experiment, XAS-XANES, XFM

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No

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No

Are you an ECR? (<5 yrs</br>since PhD/Masters)

What is your gender?

Female

Primary author(s) : CUMBERLAND, Susan (Australian Synchrotron)

Co-author(s) : Dr ETSCHMANN (Monash University); Prof. BRUGGER, Joël (Monash University); Dr KAPPEN, Peter (Australian Synchrotron); WILSON, Sasha (Monash University)

Presenter(s) : CUMBERLAND, Susan (Australian Synchrotron)

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