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Bioaccumulation of metals by lichens: Uptake of aqueous uranium by *Peltigera membranacea* as a function of time and pH

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Abstract

Uranium sorption experiments were carried out at ~25 °C using natural samples of the lichen *Peltigera membranacea*. Thalli were incubated in solutions containing 100 ppm U for up to 24 h at pH values from 2 to 10. Equilibrium sorption was not observed at less than ~6 h under any pH condition. U sorption was strongest in the pH range 4–5, with maximum sorption occurring at a pH of 4.5 and an incubation time of 24 h. Maximum U uptake by *P. membranacea* averaged ~42 000 ppm, or ~4.2 wt% U. This appears to represent the highest concentration of biosorbed U, relative to solution U activity, of any lichen reported to date. Investigation of post-experimental lichen tissues using electron probe microanalysis (EPM) reveals that U uptake is spatially heterogeneous within the lichen body, and that U attains very high local concentrations on scattered areas of the upper cortex. Energy dispersive spectroscopic (EDS) analysis reveals that strong U uptake correlates with P signal intensity, suggesting involvement of biomass-derived phosphate ligands or surface functional groups in the uptake process.