Sr uptake in the freshwater liverwort *Riccia fluitans* L.

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Sr is a radioactive isotope of strontium produced by nuclear fission, with a half-life of 28.8 years. This artificial radioisotope is present in natural ecosystems as the results of radioactive fallout from nuclear weapons or releases during nuclear power plants accidents; because of its similarity with Ca\(^{2+}\) is quickly incorporated into the biota. The high mobility of Sr\(^{2+}\) in aquatic compared with terrestrial ecosystems makes the uptake and accumulation of \(^{90}\)Sr higher in aquatic than in terrestrial plants (Kalinichenko *et al.*, 2018). Here we analyse the uptake rate, kinetics and retention, concentration factor (CF) of \(^{90}\)Sr in the freshwater liverwort *Riccia fluitans*.

\(^{90}\)Sr uptake by *R. fluitans* shows a bi-phasic kinetics that fits the Michaelis & Menten model in both micro and milimolar concentration ranges. Apparent semi-saturation constants (\(K_M\)) were 15 µM and 2 mM for the high and low affinity ranges, respectively. The presence of the K-channels blocker tetraethyamonium (10 mM TEA) inhibits \(^{90}\)Sr uptake by only a 25%. However, the presence of 1 mM La\(^{3+}\) completely inhibits \(^{90}\)Sr uptake in this plant. Maximum incorporation rate occurs at alkaline external pH (8.3), either in plants grown in the presence of K\(^{+}\) (K\(^{+}\)-sufficient plants) or in the absence (K\(^{+}\)-deficient plants). Finally, gradual increases of the Ca\(^{2+}\) concentration in the assay medium progressively inhibits \(^{90}\)Sr uptake. CF values are higher in K\(^{+}\)-deficient plants, with a maximum of 1500, than in K\(^{+}\)-sufficient (maximum CF of 600) and show similar responses to inhibitors, pH or Ca\(^{2+}\) than the described for uptake rates. CF values progressively decrease at increasing external Ca\(^{2+}\) concentrations, higher CF values are found at pH 8.3 but lower values are observed in the presence of TEA, being close to zero in the presence of La\(^{3+}\). The different \(^{90}\)Sr uptake rates in K\(^{+}\)-sufficient and K\(^{+}\)-deficient plants and TEA sensitivity indicate that one part of \(^{90}\)Sr would be transported through non-selective cation channels. Furthermore, Ca\(^{2+}\) and La\(^{3+}\) sensitivities suggest that \(^{90}\)Sr could be incorporated through Ca\(^{2+}\) channels.

References


Acknowledgements & Funding

Spanish MINECO: BFU2017-85117-R and BIO2016-81957-REDT