



## Biosorption of Pb(II) from aqueous solution using Rooibos shoot powder (RSP)

Sheku Alfred Kanu, Mambo Moyo\*, Caliphs M. Zvinowanda, Jonathan O. Okonkwo

*Department of Environmental, Water and Earth Sciences, Tshwane University of Technology, 175 Nelson Mandela Drive, Pretoria, South Africa, Tel. +27 72 695 8453; email: kanu.popfred@gmail.com (S.A. Kanu), Tel. +27 83 984 7553; email: moyom@msu.ac.zw (M. Moyo) Tel. +27 12 382 6281; email: zvinowandacm@tut.ac.za (C.M. Zvinowanda), Tel. +27 82 840 9571; email: OkonkwoOJ@tut.ac.za (J.O. Okonkwo)*

Received 22 July 2014; Accepted 30 December 2014

---

### ABSTRACT

Rooibos (*Aspalathus linearis*) plants are cultivated for the production of the Rooibos tea. In this work, biosorption process of Pb(II) from aqueous solution on Rooibos shoot powder (RSP) was studied in a batch process. The effect of experimental parameters such as solution pH (2–9), contact time (30–180 min) and initial Pb(II) concentration (25–400 mg L<sup>-1</sup>), adsorbent dosage (0.2–2.1 g), and temperature (25–80 °C) on biosorption process was examined. In an attempt to determine the biosorption capacity and rate of Pb(II) removal, isotherm and kinetic data were modeled using different equations. To this end, the biosorption process by RSP followed the Langmuir model for Pb(II) ions ( $R^2 = 0.9907$ ), with maximum monolayer adsorption capacity of 18.90 mg g<sup>-1</sup>. Kinetic data were properly fitted with the pseudo-second order kinetic model, and it can be seen that the calculated  $q_e$  (cal) value (11.31 mg g<sup>-1</sup>) agrees with the experimental value (12.80 mg g<sup>-1</sup>). Furthermore, the biosorbent showed good removal of Pb(II) from industrial wastewaters.

*Keywords:* Biosorption; Rooibos shoot powder; Isotherm; Kinetics; Wastewater

---

\*Corresponding author.