



FTIR and kinetic modelling of fungal biosorbent *Trichoderma asperellum* for the removal of Pb(II), Cu(II), Zn(II) and Cd(II) from multi-metal solutions

Carrie Siew Fang Sim, Adeline Su Yien Ting*

School of Science, Monash University Malaysia, Jalan Lagoon Selatan, 46150 Bandar Sunway, Selangor, Malaysia, Tel. 60 3-5514 6105; Fax: +60 3-55146184; emails: adeline.ting@monash.edu, adelsuyien@yahoo.com (A.S.Y. Ting); Tel. +60 3-5514 6000 Ext. 62012; email: carriesim@hotmail.com (C.S.F. Sim)

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ABSTRACT

Metal biosorption potential of Pb(II), Cu(II), Zn(II) and Cd(II) by *Trichoderma asperellum* in multi-metal solutions was compared against single-metal solutions to mimic occurrence in natural wastewater. Significantly lower metal removal was observed in multi-metal solutions compared to single-metal solutions. Antagonistic metal interaction may have led to poor metal removal in multi-metal solution (equilibrium achieved after 360 min) although biosorption occurred more rapidly in single-metal solution (equilibrium detected as early as 120 min). Preference for metals was consistent in both metal solutions, preferring Pb(II) > Cu(II) > Zn(II) ≥ Cd(II), albeit lower levels removed in multi-metal solutions. Binding of metals involved functional groups such as amino (–NH₂), carbonyl (C=O) and sulphur (–S) discovered from ATR-FTIR analysis. Metal biosorption by *T. asperellum* in both metal solutions was mainly via a rate-limiting chemisorption, with compliance to pseudo-second order kinetic.

Keywords: ATR-FTIR analysis; Biosorption; Kinetic modelling; Multi-metal solution; Single-metal solution; *Trichoderma asperellum*

* Corresponding author.