Thermokinetic Comparison of Trypan Blue Decolorization by Free Laccase and Fungal Biomass

N. N. A. Razak • M. S. M. Annuar

Received: 8 February 2013 / Accepted: 6 January 2014
© Springer Science+Business Media New York 2014

Abstract Free laccase and fungal biomass from white-rot fungi were compared in the thermokinetics study of the laccase-catalyzed decolorization of an azo dye, i.e., Trypan Blue. The decolorization in both systems followed a first-order kinetics. The apparent first-order rate constant, $k_1'$, value increases with temperature. Apparent activation energy of decolorization was similar for both systems at $\sim 22$ kJ mol$^{-1}$, while energy for laccase inactivation was 18 kJ mol$^{-1}$. Although both systems were endothermic, fungal biomass showed higher enthalpy, entropy, and Gibbs free energy changes for the decolorization compared to free laccase. On the other hand, free laccase showed reaction spontaneity over a wider range of temperature ($\Delta T = 40$ K) as opposed to fungal biomass ($\Delta T = 15$ K). Comparison of entropy change ($\Delta S$) values indicated metabolism of the dye by the biomass.

Keywords Azo dye • Decolorization • Laccase • Thermodynamic • Kinetics • White-rot fungi