PENTACHLOROPHENOL SORPTION BY *RHIZOPUS ORYZAE* ENHE

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Introduction. Pentachlorophenol (PCP) was used as biocide and as wood preservative. Now its use is restricted to preserve wood for utility poles used in ships due to the PCP recalcitrant nature, which has resulted in the contamination of soils and groundwater. PCP is very toxic for many life forms, for this reason bio-removal processes from the environment have been studied. The biosorption approach is an alternative technique of uptake for PCP. The pH plays an important role in this process because solubility of PCP depends on the pH.

The aim of this work was to study the effect of pH and temperature on sorption of PCP by non-viable *R. oryzae* ENHE biomass.

Methods. We used *R. oryzae* ENHE, a zygomycete isolated from a PCP-contaminated soil (1), for the experiments of this work. Sorption kinetics and isotherms studies were carried out at three different pH values. The non-linear Langmuir, Freundlich and Redich-Peterson models were used to describe the PCP sorption by the fungus. PCP was quantified by HPLC, performed in a Water System 600 solvent delivery system equipped with a 996 Photodiode Array Detector at 303 nm.

Results. The effect of pH on PCP sorption was studied, three different values of pH: 5.0, 6.0, and 8.0 were assayed. After adjusting the pH of the solutions, the PCP needed to reach a final concentration of 10 mg L^{-1} was added and the pH of the solutions changed when PCP or biomass were added (table 1).

Table 1. Changes of pH during the sorption process of PCP by *R. oryzae* ENHE biomass

	pH		
Water°	5.0	6.0	8.0
Solution of PCP*	5.5	6.1	6.9
Solution of PCP+Biomass†	6.4	6.4	6.7
Solution of PCP+Biomass after 8 hᵠ	6.2	6.0	6.5

° pH adjusted initially before adding PCP
* Solutions with a final concentration of 10 mg PCP L^{-1}
† pH measured after adding biomass
ᵠ pH at the sorption equilibrium

Results of kinetics sorption indicate that the PCP sorption is very fast, the sorption equilibrium was reached at 30 min of contact. At this time, the fungal biomass had sorbed 34.8%, 29.8%, and 18.1% of the initial PCP at pH 5.0, 6.0, and 8.0, respectively. Data from the isotherms fitted well with the three models used. The sorption experiments carried out at pH 8.0 reached the saturation level at 2.03 mg PCP L^{-1}, probably because biomass at this pH could not sorb more PCP molecules, in contrast with the experiments carried out at pH 5.0 and 6.0, where the saturation level was not achieved (figure 1). This sorption behavior agrees with other results reported previously (2,3)

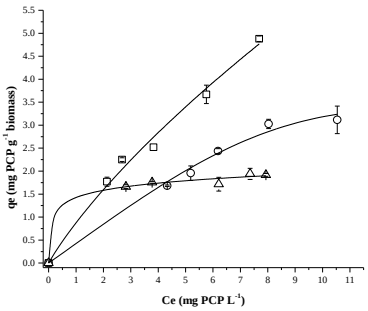

Fig. 1 Effect of pH on the sorption isotherms of PCP by non-viable *R. oryzae* ENHE biomass using Redlich-Peterson model. (□) pH 5.0; (○) pH 6.0; (Δ) pH 8.0

Conclusions. The pH affects the solubility of PCP. The sorption ability of PCP by the non-viable *R. oryzae* ENHE biomass is favored at low pH. The highest q_m (maximum sorption ability) of PCP for the non-viable *R. oryzae* ENHE biomass obtained in this study from the Langmuir isotherm was found at pH 5.0.

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References.

1. Leon-Santiesteban H, Meraz M, Wrobel K, Tomasini A (2011). *J. Hazard. Mater.* 190: 707-712.
2. Deng SB, Ma R, Yu Q, Huang J, Yu G. (2009) *J. Hazard. Mater*. 165: 408-414.
3. Mathialagan T, Viraraghavan T. (2009) *Bioresour. Technol*. 100: 549-558.