

Exploration of Free and Immobilized Laccase Enzymes for the Treatment of Paper Industry Effluent

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Abstract—Industries like pulp and paper mills are water-intensive and thus generate wastewater daily containing environmental contaminants like color, lignin, and phenolic compounds. Traditional wastewater treatment techniques are no longer effective in removing some of the pollutants that are not generally in municipal wastewater. Therefore, it is imperative to continue reviewing and researching alternative technologies to lessen the adverse effects on the environment. The use of biocatalysts is one such technique for eliminating these pollutants in wastewater. In this study, the application of free and immobilized laccase enzymes is explored on the effectiveness in removing color, biochemical oxygen demand (BOD), chemical oxygen demand (COD), lignin, and total phenols. The effluent samples were taken from the pulp and paper industry in the South of Durban (South Africa). The effluent was screened for debris before being used in the reactor. The research uses the design of experiments technique developed by Taguchi to identify optimized conditions for the reactor performance. It uses a typical orthogonal matrix L9 to investigate four independent factors at three levels. The variables of interest are reaction time, catalyst concentration, reactor temperature, and pH level. Finally, the reusability of the catalyst was investigated to eliminate the generation of waste from the proposed treatment technique. The study will report the preliminary results of the treatment system. This research serves as a baseline for alternative treatment technologies to traditional methods and offers insightful information regarding the use of biocatalysts for the elimination of pollutants in the pulp and paper industrial wastewater. The findings will serve as a foundation for future investigations into improving biocatalyst-based water treatment procedures.

Keywords— Laccase, Enzymes, Paper Effluent, Industrial Wastewater.

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