ADSORPTION OF HRP ON AGAVE-FIBER/HDPE FOAMED COMPOSITES AND ITS POSSIBLE USE IN THE DEGRADATION OF A TEXTILE DYE

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Introduction

Enzymatic degradation is an efficient approach that can convert toxic wastes into products that are innocuous to the environment, avoiding the need to completely degrade or remove them.[1,2] Peroxidases have ideal biocatalyzing characteristics including temperature and pH resistance, high stability and a wide range of substrates that can be used, besides its low cost of production.[3] In this work, horseradish peroxidase (HRP) was physically adsorbed on foamed composites of high density polyethylene (HDPE) and agave fiber. Adsorption conditions were optimized measuring the enzymatic activity at different values of concentration, time, pH and temperature.

Experimental Part

Foamed HDPE pellets were produced by extrusion using a twin screw counter-rotating extruder Model ZSE27 (Leistritz), equipped with a down-line pelletizer and using a screw speed of 40 rpm. Pellets of HDPE were mixed with 5% (w/w) agave fiber and 1% (w/w) ACA as foaming agent with 0.2% (w/w) zinc oxide as catalyst. All experiments were carried out using a shaker incubator model LSI-3016A (LabTech). Adsorption of the HRP enzyme was done using different concentrations in 50 mM acetate buffer at pH 5. pH studies were done using acetate buffer (pH 4.0-5.0), PBS buffer (5.5-7.0) and Tris buffer (7.5-9.0).

Results and Discussions

Fig. 1 depicts the activity comparison between immobilized HRP vs. in solution, changing the pH value in the immobilization procedure. Activity was detected in the whole range of pH studied, due to the different HRP isoenzymes present in the work. The highest values were obtained using acetate buffer in the immobilization protocol, while the PBS buffer gave the highest values in solution experiments.

Temperature experiments are depicted in Fig. 2; a typical bell shape activity response is observed for the HRP in solution, while activity for the immobilized enzyme is more stable at temperatures above 65°C.

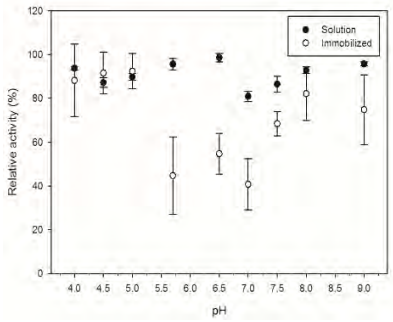

Figure 1. Activity response varying pH values, using HRP immobilized vs. in solution.

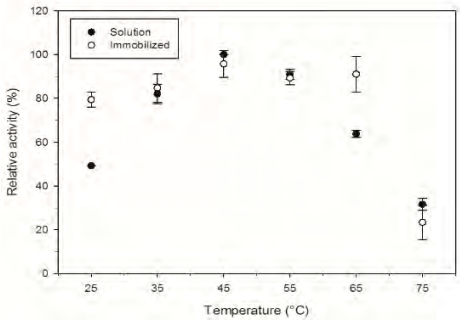

Figure 2. Effect of temperature on the activity of HRP, immobilized vs. in solution.

Conclusions

The use of a foamed composite that incorporates agave fiber is an interesting platform for the immobilization of enzymes. It was possible to optimize several conditions of the HRP physical adsorption and this platform can be used for the degradation of a textile dye.

Acknowledgment: CONACYT, CUCEI, UdeG

References

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