Evaluation of Ligninolytic Enzymatic Activity in Acrylamide-Potassium Acrylate Copolymer for Degradation of Chlorinated Compounds

Mónica Cristina Vargas-Romero (monicacvargasr@gmail.com) Adriana Saldaña-Robles, Rafael A. Veloz-García, and Graciela M.L. Ruiz-Aguilar (Universidad de Guanajuato, Irapuato, Gto., México)
Nanh Lovanh (USDA, Bowling Green, KY, USA)

Background/Objectives: It has been shown that the ligninolytic enzymes of white rot fungi are capable in degrading a great variety of recalcitrant substances and have a higher yield when these enzymes are encapsulated. Enzymatic encapsulation confers some protection for the enzymes and their reusability. This becomes important when conditions are unfavorable for fungal growth but could be suitable for enzymatic action. Although there are many enzyme immobilization techniques, some are expensive or require specialized equipment. Thus far no reports of entrapment or retention of ligninolytic enzymes have been found on copolymers of acrylamide and potassium acrylate. The copolymer is composed of a polymer network that has the capacity to absorb large amounts of solvent due to its elastic three-dimensional networks. Most applications of these copolymers are focused on the medicine and the pharmaceuticals fields as well as controlled release of drugs, and sometimes to retain water in farming processes. The objective of this project is to preserve the activity of the ligninolytic enzymes derived from the fungus *Trametes versicolor* using the copolymer of acrylamide and potassium acrylate as transport vector. It is hypothesized that the vector will help to gradually disaggregate the enzymes allowing them to withstand changes in pH and temperature in soil and fluids.

Approach/Activities: Our lab has carried out the standardization to use filter medium containing *T. versicolor* enzymes (conditioned medium) in the presence of acrylamide-potassium acrylate copolymer. For this, laccase stability was determinate at pH 8, 9 and 10, in liquid medium. The conditioned medium was used in the presence of the acrylamide potassium acrylate copolymers (1-2 mm and 2-4 mm) to evaluate enzymatical activity. Percentages of absorption and desorption were also studied based on the amount of copolymer and conditioned medium present. In addition, index of swelling and wet weight were determinate to consider for further copolymer-conditioned medium´s application on soil. The degradation of the pollutant boscalid in the presence of the polymer with the conditioned medium was determined by measuring the absorption in a UV / Vis spectrophotometer at 230 nm.

Results/Lessons: The acrylamide-potassium acrylate copolymer could preserve the enzymatic activity of laccase. It was found that the copolymer did not affect the active site in the laccase enzyme. Exposition time of the complete absorption of the conditioned medium was achieved when medium and polymer ratio was 0.2:10 for 24 h of incubation time. The absorption capacity of this copolymer in conditioned medium was 50 times its weight. The copolymer was exposed to a chlorinated compound in liquid solution, in this case boscalid, showing a reduction greater than 50% of concentration of this pollutant, using a ratio to 3:10 to copolymer with conditioned medium in a boscalid solution 5 ppm for 5 days at room temperature 25-28°C. The copolymer technology from this study has a great potential for use in emerging industries and processes such as paper, textile and others where cost is prohibited and required use of alternative methods.