USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003DE23B

Title: BIOLOGICAL AND ENZYMATIC TREATMENT OF A FOOD PROCESSING WASTEWATER

Project Type: Research

Focus Categories: Waste Water, Treatment, Water Quality

Keywords: biological treatment, remediation, food processing wastewater

Start Date: 06/01/2003

End Date: 02/28/2004

Federal Funds Requested: $1500.00

Matching Funds: $3000.00

Congressional District: At large

Principal Investigators: Chirnside, Anastasia

Abstract: The quality of the nation's surface waters depends upon the implementation of the regulations of the Clean Water Act (CWA). Specifically, the establishment of the National Pollutant Discharge Elimination System (NPDES) provides control over the amount and quality of wastewater that is discharge to surface waters. Wastewater must meet certain effluent limitations before it may be discharged so that minimum pollution occurs. These limitations are based on the Best Available Technology (BAT) to ensure and maintain surface water quality (La Grega et al., 1994). Therefore it is important that the BATs are re-evaluated often and updated to reflect current understanding of pollution control. A wastewater from a soy flour processing plant has a NPDES permit to discharge even though it has high levels of Total Kjeldahl Nitrogen (TKN). The reasoning for this decision is that the nitrogen is in a complex form that is unavailable to the degrading organisms and therefore will not add to the degradation of the surface water quality. But is this assumption really true? What about photo-degradation processes? It would be better if technology could be developed that can treat and remove this nitrogen before the wastewater is discharged. The objective of this project is to investigate possible treatment technologies. In recent years white rot fungi, specifically, Phanerochaete chrysosporium, have been found to have the ability to degrade an extremely diverse range of very persistent or toxic

environmental pollutants. Consequently, this has brought the fungi great attention in the field of environmental remediation. Studies have shown that the white rot fungus is able to degrade pesticides, polyaromatic hydrocarbons, polychlorinated biphenyls (PCBs), and most halogenated aromatics. The very nonspecific nature of the mechanisms used by these fungi allows them to degrade even complex mixtures of pollutants. The white rot fungi secrete peroxidase enzymes and hydrogen peroxide. These enzymes catalyze the reactions that result in the depolymerization of lignin (the structural polymer in woody plants) (Wu et al.,1996). Optimal activity of the enzyme is accomplished at a pH of 4 to 4.5. The white rot fungus can tolerate a wide temperature range from about 10 °C to 43 °C. Previous studies utilizing the fungus in an aerobic attached growth, packed bed bioreactor have found that the high pH of the wastewater causes inhibition of TKN and Chemical Oxygen Demand (COD) degradation (Hetrick and Chirnside, 2001). They have also studied the effectiveness of pH adjustment of wastewater as it enters the bioreactor. It was hoped that by mixing the wastewater with a low pH (4.5) starvation media, the pH of the wastewater would have been buffered to a much more suitable pH for the fungus. After the experiment, there was a noticeable decrease in TKN and COD concentration until the pH of the influent was much greater than the optimal range of 4-4.5 for the fungus. Therefore, adjustment of the wastewater pH before introduction into the bioreactor may overcome these difficulties.
