CENE 486 Capstone Project—Adsorption of Copper and Lead from Mine Wastewater Using Mushrooms as a Bio sorbent

Environmental W.W. Engineering

Procedure: Mushroom Adsorption Setup

Created by: William Bain and Nolan Maxwell

Application: Generate adsorption isotherm data

Summary: The aim of this experiment is to quantitatively show the adsorption capabilities of mushrooms when used as a bio sorbent. This is accomplished by creating a mine wastewater sample containing lead and allowing the solution to adsorb to coarsely processed mushroom that was pretreated with sodium hydroxide. The adsorption of lead is measured using an XRF by analyzing the change in metal concentration in both the retained liquid and mushroom biomass. An adsorption isotherm will be constructed from the collected data allowing for further insight into the adsorption qualities of white button mushrooms.

1.0 Equipment

(a) 36 Glass Reaction Vials (60 mL)
(b) 50 mL Volumetric Flask w/ Filter Funnel
(c) Filter Paper
(d) Rubber Vacuum Hose
(e) Analytical Balance
(f) Rotary Shaker Table
(g) Weight Paper
(h) PPE (gloves, coat, goggles, etc.)
(i) Fume Hood
(j) 36 XRF Sample Cups

2.0 Reagents and Materials

(a) 15 g of Pre-Treated Agaricus Bosporus (White Button Mushroom)
(b) 1000 ppm Copper Mine Waste Solution (2L)

(c) 1000 ppm Lead Mine Waste Solution (2L)

3.0 Mushroom Adsorption of Lead

1. In order to create the samples for the lead adsorption experiment weigh out ten triplicate masses of mushrooms at the following weights from the 15 g of dried pretreated mushrooms (prepared using the Mushroom Preparation and Pretreatment Procedure): 100 mg, 200 mg, 300 mg, 400 mg, 500 mg, 600 mg, 700 mg, 800 mg, 900 mg, and 100 mg. There should be 30 mushroom samples in total. In addition to the 30 samples, weight out three 1000 mg mushroom samples for the purpose of creating three control samples.

2. Obtain 33 glass reaction vials, label each vial by sample number, and pour each mushroom sample into each corresponding vial.

3. While in the fume hood pour 50 mL of the 1000 ppm Lead Mine Waste Solution into each vial using a funnel and a volumetric flask. Cap each vial.

4. Place the three 10 mg samples into three glass reaction vials and fill each vial with 50 mL of distilled water. Cap each vial. These three samples will serve as the control for this experiment

5. Place all vials on a Rotary Shaker Table for 24 hours.

6. Pipette approximately 4 mL of liquid from the top of each vial and put into a labeled XRF sample cup that is label the same way as the samples in each vial.

7. Filter each mushroom sample separately by using a suction flask and filter funnel with filter paper. DO NOT COMBINE ALL FILTERED LIQUIDS. The remaining filtered liquid will be discarded into the lead/copper waste bucket.

8. Place each mushroom sample in an evaporating dish and place in drying furnace at 40°C for 24 hours. Each sample dish will be labeled with the corresponding label in which the sample came from.

9. Prepare the XRF sample cups by first capping one side of the cup with a plastic liner, then fill the sample cup with the liquid sample retained in the sample flask. Cap the XRF sample cup using another plastic liner. Repeat for each filtered mushroom sample. Store remaining liquid samples in separate containers for potential repeated analysis.

10. After 24 hours remove mushrooms from the drying furnace, allow to cool for 30 minutes. Place each sample into a XRF sample cup and then cap each sample. At this point there should be a total of 33 mushroom samples including the three control samples.