

PASSIVE TREATMENT OF ACID MINE DRAINAGE USING COAL COMBUSTION BY-PRODUCTS AND SPENT MUSHROOM SUBSTRATE: RESULTS OF COLUMN STUDY¹

by

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Abstract A column study was conducted to evaluate the feasibility of using of coal combustion by-products (CCB) as alkaline materials in a field scale downflow constructed wetlands for acid mine drainage treatment. Five columns (15.24 cm in diameter and 91.44 cm high) were constructed and filled with a combination of spent mushroom substrate (SMS) and one of three alkaline materials (limestone, hydrated fly ash, or fluidized bed ash). The five mixtures utilized were 10% fluidized bed ash/40% limestone (FBA/LS), 10% fluidized bed ash (FBA), 50% limestone (LS), 50% hydrated fly ash (HFA), and 50% sieved (>1.5 cm) hydrated fly ash (S. HFA) with the remainder as SMS on a w/w basis. Column received synthetic acid mine drainage containing; 400 mg/L iron, 59 mg/L aluminum, 11 mg/L manganese, 50 mg/L magnesium, 40 mg/L calcium, and 1200 mg/L sulfate for 5 months. Anoxic conditions in the influent reservoirs were maintained by a positive nitrogen pressure head. Flow rates of 2.0 mL/minute to each column were maintained by a multichannel peristaltic pump. For all columns, effluent acidity concentrations were less than influent acidity concentration (877 ± 30 , $n=75$). Mean effluent acidity concentrations were 241 mg/L (FBA/LS), 186 mg/L (FBA), 419 mg/L (LS), -28.5 mg/L (HFA), and 351 mg/L (S. HFA), respectively. While all column produced measurable alkalinity, only the HFA column produced a net alkaline discharge. The results of these column studies are applicable to the design and sizing of innovative field scale systems using alkaline-rich CCB's.

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