

ANALYSIS OF SUBSTRATE LEACHATE FROM AN INNOVATIVE VERTICAL FLOW AMD PASSIVE TREATMENT SYSTEM¹

by

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Abstract: Although many organic substrate-based acid mine drainage (AMD) passive treatment systems have been constructed, analyses of initial leachate components has been limited. Labile organic materials, although providing an effective substrate for important bacterial processes in AMD treatment, may leach organic compounds, nutrients and other substances into receiving waters. Decreased dissolved oxygen levels, discoloration, nutrient enrichment and subsequent eutrophication may result. In this study, organic and inorganic components of substrate leachate from an innovative vertical flow acid mine drainage (AMD) passive treatment system were determined during initial operation. A portion (approximately 17 L/minute) of an AMD discharge (2500 L/minute mean discharge rate, >450 mg/L acidity as CaCO₃ eq., pH 3.5, >200 mg/L total Fe, 10 mg/L Al³⁺, 11 mg/L Mn⁺² and 1800 mg/L SO₄⁻²) from an abandoned underground mine in southeastern Oklahoma was directed to a pilot-scale treatment system. The treatment system consists of four 185 m² in-series cells and is comprised of alternating vertical flow anaerobic compost wetlands (VFs) and surface flow aerobic settling ponds (APs). The substrate in the VFs consists of spent mushroom substrate (SMS), high CaCO₃ limestone gravel, and hydrated fly ash (HFA) in a 2:1:0.1 ratio by volume. HFA is a coal combustion product and has been identified as an effective alkalinity generating material in laboratory studies. Field data (pH, temperature, dissolved oxygen, conductivity and alkalinity) and water samples for subsequent analyses were collected at the discharge, at the inflow to each cell, and at several locations in the receiving waters. Initial data indicate pH increase to 7.3, and generation of approximately 350 mg/L alkalinity as CaCO₃ eq. by the second aerobic settling pond. Total organic carbon, chemical oxygen demand, color, metals, and concentrations of other significant components were measured at all sampling locations.

Additional key words: constructed wetlands, water quality, organic acids,

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