Surface Coal Mine Land Reclamation Using a Dry Flue Gas Desulfurization Product: Short- and Long-term Water and Microbial Responses

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ABSTRACT

The potential negative environmental impact of abandoned coal-mined lands is a worldwide concern. A field study was conducted investigating the use of a dry flue gas desulfurization (FGD) product for reclamation of abandoned coal-mined land in Ohio. FGD product was applied to a mine site at a rate of 280 Mg ha⁻¹ alone or with 112 Mg ha⁻¹ compost. These treatments were compared to a conventional reclamation treatment using 20 cm of re-soil material plus 157 Mg ha⁻¹ of agricultural limestone. A grass-legume sward was planted, and microbial and water responses were analyzed. Chemical properties of surface runoff and water from tile located 1.2 meters below ground surface were measured over short- (1-4 yr) and long-term (14-20 yr) periods following reclamation. pH of runoff water increased from approximately 3 to over 7 for all treatments, remaining at this level for 20 yr. The pH of tile flow was over 5 and remained at this level for 20 yr. Compared to conventional reclamation, Ca, S and B concentrations in water generally increased following treatments with FGD product. Concentrations trace elements measured were generally not statistically increased in surface runoff and tile flow water. Occasional elevation of As, Ba, Cr and Hg concentrations were found compared to conventional reclamation in runoff or tile flow from plots treated with FGD product. Acidithiobacillus ferrooxidans and A. thiooxidans bacteria populations in reclaimed plots significantly decreased compared to untreated areas. These results suggest use of FGD products for remediating coal-mined sites can provide effective, long-term reclamation.