DEVELOPMENT OF A RAPID ASSESSMENT METHOD FOR QUANTIFYING CARBON SEQUESTRATION ON RECLAIMED COAL MINE SITES[1]

S. Maharaj[2], C.D. Barton[3], A.D. Karathanasis[4], H.D. Rowe[5], and S.M. Rimmer[5]

Abstract: Projected climate change resulting from elevated atmospheric carbon dioxide has given rise to various strategies designed to sequester carbon in terrestrial ecosystems. Reclaimed coal mine soils present one such potential carbon sink. However, quantifying "new" carbon (carbon that has been added to soil through recent biological processes) on reclaimed mine soils have proven to be difficult due to carbonates and coal particles present in the reclaimed coal mine spoils. Visible coal particles can be removed, but the microscopic coal dust particles remain. The focus of this project is to assess the potential of thermogravimetric analysis as a rapid, simple and direct method for differentiating and quantifying "new" carbon from "old" carbon (carbon of geologic origin) on reclaimed coal mine sites and provide a standard procedure for determining carbon sequestered in soil "sinks." Thermogravimetry is a physico-chemical technique where the weight change is measured and recorded during the incremental heating of the soil sample over a temperature range of 25 to 1000 degree C. Grass litter and limestone were used as representative organic and inorganic carbon fractions, while coal was used to differentiate the "old" and "new" carbon within the organic fraction. Recoveries of mixtures at the 95% confidence interval were found to be 94.49 ± 4.23% (coal), 93.67 ± 2.11% (litter), and 108.88 ± 2.88% (limestone) respectively. Each of the above components appeared as distinct separate peaks on the thermograph, with litter appearing between 270-395 degree C, coal 415-520 degree C, and limestone 700-785 degree C. Overlapping peaks for the organic carbon represented by the grass litter may be indicative of cellulose and lignin fractions. Ongoing work in this area is being carried out to separate such peaks which may further enhance TG as an effective method to determine "new" carbon and to simultaneously monitor organic matter degradation.

Additional Key Words: Reforestation, carbon sequestration, thermal analysis

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[2]Sally Maharaj, Graduate Research Assistant, Department of Forestry, University of Kentucky, Lexington, KY, 40546, email: sally.maharaj@uky.edu [3]Christopher D. Barton, Assistant Professor, email: barton@uky.edu [4]Professor, Department of Agronomy email akaratha@uky.edu [5]Assistant Professor, Geological Sciences Department email hrowe@uky.edu Associate Professor email sremmer@uky.edu