

Changes in Total and Available Phosphorus Contents in Poultry Litter Biochar Co-pyrolyzed with Eppawala Rock Phosphate at Different Temperatures

P.O. Sarachchandra¹, R.S. Dharmakeerthi^{2*}, A.K. Karunaratna³

¹*Postgraduate Institute of Agriculture*, ^{2*}*Department of Soil Science*,
³*Department of Agricultural Engineering, University of Peradeniya, Peradeniya,*
20400, Sri Lanka

**dharmakeerthi@agri.pdn.ac.lk*

Availability of phosphorus (P) in Eppawala Rock Phosphate (ERP) and poultry litter (PL) can be increased by heat treatment. The objective of this study was to determine the effect of temperature on total and available P contents in poultry litter biochar (PLB) when co-pyrolyzed with ERP. Poultry litter was slow pyrolyzed at 350, 500, 650 and 900 °C, with 0%, 1% and 5% (w/w) ERP with a heating rate of 10 °C/min and residence time of 2 h. ERP was also heated to same temperatures without mixing them with PL. Total and Mehlich-3 extractable P (Av-P) contents were determined in the heat treated mixtures. Total P content in ERP was decreased significantly ($p < 0.001$) when heated beyond 650 °C. ERP heated at 350 °C had significantly ($p = 0.013$) higher available P content (0.807%) than untreated ERP (0.70%). A significant interaction effect ($p < 0.005$) between temperature and PL:ERP rates on the Av-P in co-pyrolyzed PLBs was observed. While Av-P content did not significantly change when the temperature was increased in PLBs co-pyrolyzed with 0 and 1% ERP, it increased from 0.68% to 1.50% when PL was co-pyrolyzed with 5% ERP at 650 °C. Increasing the temperature further decreased Av-P content in PLB with 5% ERP. Total P content however was affected only by temperature main effect ($p < 0.005$) where it increased by 25% from 3.2% at 350 °C to 4.4% at 650 °C and then decreased to 2.0% at 900 °C probably due to P volatilization at temperature beyond 760 °C. The present study confirms that co-pyrolysis of PL with ERP at 650 °C improves the P availability in PLB and the effect vary with the PL:ERP ratio. It was concluded that co-pyrolyzing PL with ERP is a potential technology to utilize ERP as a P source in annual crop production systems.

Keywords: Biochar, Co-pyrolysis, Eppawala rock phosphate, Volatilization