

## **Effect of biochars produced from slow pyrolysis and gasification on their characterisations and carbon mineralisation in the acid soil**

### **ABSTRACT**

More than two million tons of agricultural wastes are produced annually in country-region place Malaysia. These agricultural wastes provide feedstock for biochar production, which contributes insignificant net carbon dioxide to the atmosphere after soil incorporation. Three kinds of primary biochar were used in this study, namely, empty fruit bunch biochar (EFB), wood biochar (WB), and rice husk biochar (RHB). EFB and WB were produced by slow pyrolysis, whereas RHB was produced by gasification. This study aimed to investigate the influence of slow pyrolysis and gasification methods on biochar chemical characteristics and short-term soil stability. Results showed that the kinetic parameters of C mineralization, which was calculated by fitting the three-pool kinetic model to evolved CO<sub>2</sub>-C under field conditions, suggested a tri-phasic C-mineralization process (labile, unstable, and recalcitrance carbon). Our estimates reflected the existence of a very labile C fraction in RHB with a very small decay constant K<sub>3</sub>. Fourier transform infrared spectroscopy and x-ray diffraction showed the three phase transitions of the biochars from the microcrystalline C of the labile fraction to the largely amorphous intermediate C of the unstable fraction and formation of turbostratic crystallite C in the recalcitrant fraction. We concluded that EFB and WB decomposed faster than RHB. Therefore, RHB was a suitable option for C sequestration in soil.

**Keyword:** Empty fruit bunch biochar; Wood biochar; Rice husk biochar; C mineralization; Labile C; Unstable carbon; Recalcitrant C