

Short-term field decomposition and physico-chemical transformation of jatropha pod biochar in acidic mineral soil

ABSTRACT

Details regarding field decomposition and transformation of biochar in Malaysia are scarce. The objectives of this study were to investigate the physico-chemical changes experienced by Jatropha pod biochar (JPB) in acidic mineral soil under field condition. Elemental composition was determined using CHNS-O analyzer and surface area with Brunauer-Emmett-Teller (BET) method. The JPB surface chemistry and structure were studied using the Fourier Transform Infrared (FTIR) spectroscopy and ^{13}C solid state Nuclear Magnetic Resonance (NMR) spectroscopy, respectively. The JPB short-term decomposition was investigated by using a litter bag study and decomposition data were best fitted by a hyperbolic decay model compared to an exponential decay model because no significant dry weight loss was detected after 4 months. Two phases (volatile and near stagnant) were detected for JPB field decomposition. The volatile phase was due to rapid loss of labile fraction such as carbohydrate during the initial 4 months. The near stagnant phase was probably due to adsorption of organic matter and soil minerals. The JPB was fragmented into smaller pieces, encouraging surface adsorption. Redox reaction was prominent as shown by the production of hydroxyl, carboxylic and phenolic functional groups. The JPB became more recalcitrant after 12 months of application to the soils.

Keyword: Litter bag study; Redox; FTIR; NMR; Hyperbolic decay model