ELS2014 –The Earth Living Skin: Soil, Life and Climate Changes
EGU – SSS Conference
Bari | Italy | 22 – 25 September 2014
ELS2014-128-1

Adsorption of carbamazepine and lincomycin on biochars produced at different temperatures

Thaisa Pegoraro (1), Mark Bezdek (2), Hui Li (2), Stephen Boyd (2), and Silvio Sampaio (1)

(1) Universidade Estadual do Oeste do Paraná (UNIOESTE), Cascavel, PR, Brazil (thaisapegoraro@gmail.com), (2) Michigan State University (MSU), East Lansing, MI, United States

It is of great importance to fully understand the occurrence, fate, transport and transformation of pharmaceuticals in the environment and that the sorption of pharmaceuticals by biochar might be one of key processes controlling transport and fate of these compounds in the environment. In this study, the behavior of the pharmaceuticals carbamazepine (CBZ) and lincomycin (LMC), affected by different pH in solution, were selected to investigate the adsorption behavior to six biochar samples produced from two different kinds of starting materials and three different temperatures of production. The raw materials, Brazilian pepper (BP) and Brazilian sugarcane bagasse (BG) were converted into biochar through slow pyrolysis at temperatures of 300C, 450C and 600C according to the method described by Yao et al. (2011). Adsorption isotherms were determined using a batch equilibrium approach. It was used 10-100 mg of each biochar and wetting with 10 mL of water for 24hrs. Pharmaceuticals solutions were added into the tubes so the final concentrations would be between 0.1-2.5 mg L-1. Tubes were rotated for 24hrs., centrifuged for 1 hr. at 3500 rpm and the supernatant was passed through 0.22 μm filters and analysed by LC-MS/MS. Each treatment was replicated two times and adsorbed compounds concentrations were calculated from difference between the initial and equilibrium aqueous phase concentrations based on the mass balance. For the pH range test, HCl and NaOH were used to control the initial pH of the solution with the intended final pH ranging around 6 and 10 for BG300 and BG600 biochars. The data analysis was performed using the Freundlich equation and the values of Kd, Kf and n were reported. Carboxylic groups and total acidity were analyzed according to Schnitzer and Gupta (1965). As a result, BG biochars had greater adsorption than BP biochars and the high pyroslysis temperature increased the adsorption of CBZ and LMC. The sorption of CBZ followed the order BP300 < BP450 < BG300 < BP600 < BG450 < BG600 and the sorption of LMC followed BP300 < BG300 < BP450 < BP600 < BG450 < BG600. The carboxyl functional groups and the total acidity were higher in the lowest temperature of biochar production (300C). For both pharmaceuticals, on BG600, the adsorption in natural pH (10.1) and pH6 did not show any difference, but for BG300 the difference between adsorption in the natural pH of the biochar (7.2) and pH 6 and 10 was considerable. For CBZ, on BG300, pH6 and pH10 decreased the adsorption compared to natural pH condition (7.2). However, for LMC, the adsorption was higher in pH6 than in natural pH (7.2) and pH10, probably due to the stronger interaction between cationic LMC species and the charges in biochar at lower pH (WANG et al., 2011). This study indicated that the carboxyl groups and total acidity might be important functions that increase the adsorption of compounds on biochars.