BIOCHARS PRODUCED WITH FAST/FLASH PYROLYSIS IN CONICAL SPOUTED BED REACTOR: POTENTIAL FOR CARBON SEQUESTRATION

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Abstract
With the objective of verifying the potential for environmental applications of different chars produced by fast/flash pyrolysis in a conical spouted bed reactor (CSBR), data/information was taken from previous studies, including 23 pyrogenic carbonaceous materials (PCM) produced with different anatomic parts of eight lignocellulosic biomasses as feedstocks, as follows: pinewood sawdust (Pin); poplar wood (Po); eucalyptus (Euc); orange waste (Ow); acacia (Ac); gorse (Car); rice husk (Rh) and; brow species mixture (Mix). These PCMs were classified according to Van Krevelen diagram (VK) (based on their O/C and H/C molar atomic ratios) and according to Spokas' approach (based on their O/C molar atomic ratio). Since PCMs obtained with fast/flash pyrolysis tends to have underdeveloped structures as a result of short operation residence time (SRT) (0.05-0.11 s) and high heating rate (HR) (10^3-10^4 °C/s), their properties are not favorable, for instance, for carbon sequestration. Even though, based on the O/C and H/C atomic ratios, all 23 PCMs met the international standards established by the Initiative Biochar Certificate (IBI) (H/C $\leq$ 0.7) and by the European Biochar Certificate (EBC) (O/C $\leq$ 0.4; H/C $\leq$ 0.7), being entitled to be named biochars. When the focus is placed on carbon sequestration applications, according to the EBC criterium (C $\geq$ 50%), besides the O/C and H/C ratio limits, four biochars obtained with rice husk biomasses were not eligible since their Carbon (C) content is <50%. Mix biochar (O/C=0.25; H/C=0.35; T=500°C) was also excluded according to Spolas' criterium which requires O/C <0.2. The remaining 18 biochars were stable with half lifetime ≥1000 years and for these biochars, the atomic ratios and the final temperature achieved during pyrolysis (O/C, H/C, T°C respectively) were: **Pin:** (0.19; 0,57, 450°C), (0.10; 0.42, 500°C), (0.05; 0.19, 600°C), (0.05; 0.19, 500°C), (0.05; 0.19, 500°C), (0.16;0.51, 400°C), (0.11; 0.40, 500°C); **Ac:** (0.16; 0.35, 500°C); **Car:** (0.06; 0.34, 500°C); **Euc:** (0.13; 0.35, 500°C); **Ow:** (0.15; 0.60, 425°C), (0.15; 0.48, 500°C), (0.13; 0.43, 600°C); **Po:** (0.16; 0.60, 435°C), (0.14; 0.61, 455°C), (0.10; 0.55, 485°C), (0.08; 0.51, 505°C), (0.14; 0.56, 525°C). A more restrictive raking still focusing on carbon soil sequestration was made, prioritizing higher temperatures for pyrolysis (500 $\leq$ T $\leq$ 600°C), higher C content (C $\geq$ 50%) and O/C < 0.2, as follows: **Pin** (0.05; 0.19, 600°C) > **Car** (0.06; 0.34, 500°C) > **Euc:** (0.13; 0.35, 500°C) > **Ow:** (0.13; 0.43, 600°C) > **Po:** (0.14; 0.56, 525°C) > **Ac:** (0.16; 0.35, 500°C). However, the potential for environmental applications of these six biochars must be experimentally demonstrated since applications of biochars produced through CSBR are seldom reported in literature.
Keywords: Lignocellulosic biomass; biochar; Van Krevelen diagram; Carbon sequestration.

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