A pulsating H2O approach to improve biochar reactivity and syngas quality: Mechanism, priority and optimum

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Abstract

The reaction of biochar-CO2 (C-CO2) is the speed-control reaction in a real-world gasifier. In this study, a new impulsive H2O(g) approach was introduced and optimized to improve the reactivity and syngas quality from biochar gasification using a TG analyzer and a tube furnace. An interaction of "independent to competitive" effect was observed during D-biochar gasified in CO2/H2O(g) under diffusion reaction regime. Micropores suitable for C-CO2 was produced by H2O(g) within a specific stage, which created the desired synergistic effect between C-CO2 and C-H2O(g). The introduction of pulsating H2O(g) was employed to supply micropores for C–CO2 and avoid the pore expansion effect of C–H2O(g) (which is negative to C–CO2). As a consequence, an improvement on the obtained syngas yield and a remarkable H2O(g)-saving effect were achieved using the new approach on the premise of not significantly reducing the corresponding carbon conversion than using the traditional mixed CO2/H2O(g) method.

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