Coffee husks gasification using high temperature air/steam agent

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Abstract
Analyses made on the world's biomass energy potential show that biomass energy is the most abundant sustainable renewable energy. The available technical biomass energy potential surpasses the total world's consumption levels of petroleum oils, coal and natural gas. In order to achieve a sustainable harnessing of the biomass energy potential and to increase its contribution to the world's primary energy consumption, there is therefore a need to develop and sustain contemporary technologies that increase the biomass-to-energy conversion. One such technology is the high temperature air/steam gasification (HTAG) of biomass. In this paper we present findings of gasification experimental studies that were conducted using coffee husks under high temperature conditions. The experiments were performed using a batch facility, which was maintained at three different gasification temperatures of 900 °C, 800 °C, and 700 °C. The study findings exhibited the positive influence of high temperature on increasing the gasification process. Chars left while gasifying at 800 °C and 700 °C were respectively 1.5 and 2.4 times that for the case of 900 °C. Furthermore, increased gasification temperature led to a linear increment of CO concentration in the syngas for all gasification conditions. The effect was more pronounced for the generally poorly performing gasification conditions of N_2 and 2% oxygen concentration. When gasification temperature was increased from 700 °C to 900 °C the CO yield for the 2% O_2concentration increased by 6 times and that of N_2 condition by 2.5 times. The respective increment for the 3% and 4% O_2 conditions were only twofold. This study estimated the kinetic parameters for the coffee husks thermal degradation that exhibited a reaction mechanism of zero order with apparent activation energy of 161 kJ/mol and frequency factor of 3.89×10^4/min.

Keywords
Coffee husks;
High temperature gasification (HTAG);
Agricultural waste;
CO/CO_2index;
Kinetics