REACTION CHARACTERISTICS OF WASTE COFFEE GROUNDS CHEMICAL-LOOPING GASIFICATION

Qingjie Guo, Key Laboratory of Clean Chemical Processing of Shandong Province, Qingdao University of Science & Technology, Qingdao 266042, Shandong Province, China
qj_guo@yahoo.com
Yunpeng Zhang, Qinqin Yang, Yongzhuo Liu, Key Laboratory of Clean Chemical Processing of Shandong Province, Qingdao University of Science & Technology, China

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Coffee grounds in chemical-looping gasification is an innovative handling approach of waste coffee grounds which couple the coffee grounds gasification and chemical looping technology together. By sol-gel method, the Fe4ATP6K1 compound oxygen carrier (OC) modified by KNO3 were prepared with Fe2O3 as an active component, natural attapugite (ATP) as an inert support. The effects of reaction temperature, steam flow as well as O/C molar ratio on coffee grounds in chemical looping gasification (CLG) were investigated in a fluidized bed using steam as gasification agent. It indicated that the Fe4ATP6K1 oxygen carrier could enhance the conversion of coffee grounds. Compared with SiO2 as bed material, the carbon conversion increased in CLG from 71.38% to 86.25%. The optimized conditions were presented as follows: the reaction temperature was 900°C, the water flow was 0.23 g·min-1, the O/C molar ratio was 1. Under these conditions, it was found that the average concentration of H2 reached a maximum value 52.75%, with the syngas production of 1.30 m3·kg-1 and H2 production of 83.79 g·kg-1, respectively. 20 redox cycles demonstrated that the Fe4ATP6K1 oxygen carrier has an excellent cyclic stability, the carbon conversion and cold gas efficiency were both above 75%, while the average gas concentration of gases were nearly stable.