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生物质炭燃烧特性与动力学分析

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Investigation on combustion characteristics and kinetics of bio-char

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摘要 利用小型固定床反应器对棉杆和木屑进行了炭化制焦实验,利用热重分析仪对制得的生物质炭进行氧化实验.基于综合反应速率方程推导了生物质炭氧化过程气固反应机理,并对热重实验结果进行拟合计算.实验结果表明,随着制焦炭化温度的升高,生物质炭的着火温度和燃尽温度升高,燃烧特性指数*S*减小;棉杆炭综合燃烧性能优于木屑炭.棉杆炭在低温段和高温段燃烧的反应机理不同,低温段燃烧反应的机理是片状内扩散反应机理,高温段燃烧反应的机理是球形界面化学反应机理.木屑炭的反应机理是球形界面化学反应机理.拟合计算求得的活化能并不能反映出生物质炭进行燃烧反应的难易程度.

关键词: 生物质　生物质炭　燃烧特性　气固反应机理　反应动力学

Abstract: The bio-char from cotton stalk and sawdust was prepared using a tubular fixed bed, and the combustion characteristics of the resulted bio-chars were analyzed with a thermogravimetric analyzer. Based on the comprehensive reaction rate equation, the gas-solid reaction mechanism of the bio-char combustion was deduced, and the thermogravimetric data of the bio-char combustion were fitted. The results indicate that as the carbonization temperature increases, the ignition temperature and burnout temperature of the bio-chars increase, while the combustion performance index (*S*) decreases. The combustion characteristics of the cotton stalk charcoal are better than that of the sawdust charcoal. The reaction mechanisms for the cotton stalk charcoal combustion are different in different temperature ranges. The charcoal combustion in lower temperature range follows the planar internal diffusion reaction mechanism, while the globular interface reaction mechanism applies to higher temperature range. The combustion reaction of sawdust charcoal follows globular interface reaction mechanism during the whole oxidation process. The reaction reactivity of bio-char combustion can't be judged by the calculated activation energy.

Key words: biomass　bio-char　combustion characteristic　gas-solid reaction mechanism　kinetics

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