

能源和环境工程

四种金属氯化物对纤维素快速热解的影响(I)Py-GC/MS实验

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摘要

通过浸渍的方式在纤维素上负载了四种金属氯化物(KCl、CaCl₂、FeCl₃和ZnCl₂), 采用Py-GC/MS装置对其进行快速热解并对热解气在线分析, 考察各金属氯化物及其负载量对纤维素热解产物的影响。结果表明, 负载金属氯化物能够显著降低纤维素的热解温度, 其中负载CaCl₂和FeCl₃会抑制纤维素热解形成挥发性产物, 而负载KCl和ZnCl₂则不会。纯纤维素快速热解主要得到了以左旋葡聚糖为主的脱水糖以及一定量的呋喃类产物, 和以羟基乙醛为主的小分子醛酮类产物。负载金属氯化物后都抑制了左旋葡聚糖的生成, 其中KCl和CaCl₂主要促进了纤维素解聚后脱水形成呋喃类产物, 以及吡喃环开裂形成醛、酮、酸等小分子产物; FeCl₃和ZnCl₂则主要是促进纤维素解聚后形成脱水糖以及呋喃类产物。

关键词

[纤维素](#) [快速热解](#) [催化](#) [Py-GC/MS](#) [金属氯化物](#)

分类号

Catalytic effects of four metal chlorides on fast pyrolysis of cellulose (I) Py-GC/MS experiments

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Abstract

Cellulose was pretreated by impregnation of four metal chlorides (KCl, CaCl₂, FeCl₃ and ZnCl₂), and then subjected to fast pyrolysis by using pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS). The pyrolysis products were on-line analyzed to reveal the catalytic effects of the four metal chlorides. The results indicated that the presence of metal chlorides reduced the pyrolysis temperature of cellulose. Moreover, the impregnation of CaCl₂ and FeCl₃ inhibited the devolatilization of cellulose considerably, while this was not the case for the impregnation of KCl and ZnCl₂. Fast pyrolysis of pure cellulose produced abundant levoglucosan, some furans as well as light carbonyl compounds, mainly including hydroxyacetaldehyde. After the impregnation of metal chlorides, the formation of levoglucosan was deeply inhibited. KCl and CaCl₂ mainly promoted the depolymerization and dehydration of cellulose to form furans, and the pyrolytic ring scission to form various linear carbonyls and acids. FeCl₃ and ZnCl₂ mainly promoted the depolymerization and dehydration of cellulose to form anhydrosugars and furans.

Key words

[cellulose](#) [fast pyrolysis](#) [catalysis](#) [Py-GC/MS](#) [metal chlorides](#)

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