

工程热物理

金属化合物对工业污水污泥燃烧的催化作用及机制

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摘要: 用热重法研究了不同金属化合物对含工业污水污泥的助燃作用, 计算了添加不同金属化合物前后污泥燃烧的特征指数和燃烧反应动力学参数, 并以酸洗污泥作为对比, 对不同金属化合物的助燃效果和催化机制进行了分析。结果表明, 含工业污水污泥中挥发分的析出和燃烧制约着整个燃烧过程, 并且污泥在低温段和高温段的燃烧特性不同。污泥添加不同金属化合物K2CO3、NaCl和Al2O3后, 其着火点有一定的下降, 对污泥的燃烧有促进作用; 不同金属元素化合物的加入对污泥燃烧性能有一定的改善, 并且在燃烧的不同阶段金属化合物表现出不同的催化能力, 其中K2CO3的催化性能强于NaCl和Al2O3。污泥经过酸洗后, 燃烧反应速率有明显的提高, 活化能降低, 综合燃烧性指数提高。不同金属化合物对污泥燃烧的催化机制不同, 对污泥着火性能的催化主要表现在金属促进了污泥中挥发性有机物的释放。金属对污泥燃烧催化的机理是金属充当氧的载体, 加快氧气扩散速度, 促进了氧的转移。

关键词: 污水污泥 催化 金属化合物 燃烧特性 动力学 热重分析

Catalytic Actions and Reaction Mechanism of Compounds With Metal Elements on the Combustion of Mixed Industrial Sludge

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Abstract: Stimulative effects of metallic compounds on industrial sewage sludge combustion and the sludge with acid washing treatment were studied by thermogravimetric analysis. The combustion characteristics index and kinetic parameters were calculated before and after adding different metal compounds. The catalytic effects and mechanism of combustion were discussed. The results show that the volatile separating and combustion control the entire combustion process. To some extent, the combustion characteristics of the sludge at low temperature are different from that at high temperature. After adding different metal compounds (K2CO3, NaCl and Al2O3), the sludge ignition point had a certain drop and the characteristics combustion index are also changed, indicating the combustion performance of the sludge was improved. Different metal compounds behave different katalysis at different combustion stage. And K2CO3 performs stronger catalytic capacity than that of NaCl and Al2O3 in the whole process. The combustion rate increase significantly and the activation energy decreases as well as general index of combustion enhanced by acid washing treatment. The catalytic mechanisms were different between the beginning of combustion and afterwards. At the beginning of combustion, the metal compounds stimulated the release of organic volatile compounds. While, at afterwards stages, the metals served as the carrier of oxygen, thus accelerated the displacing and diffusing of oxygen, made it easier for sludge to combustion.

Keywords: sewage sludge catalytic metallic compound combustion characteristic kinetics thermogravimetric analysis

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