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# Inhibiting effects of three commercial inhibitors in spontaneous coal combustion

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## ABSTRACT

Three commercial inhibitors were investigated for their suitability in preventing the spontaneous combustion of noncaking coal (NCC) and gas coal (GC), two coals of low metamorphic grades. Simultaneous thermal analysis, Fourier transform infrared spectroscopy, and kinetic analysis demonstrated that Zn/Mg/Al-CO<sub>3</sub>-layered double hydroxides (LDHs) and diammonium phosphate ((NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub>) both exhibited substantial inhibiting effects. Therefore, Zn/Mg/Al-CO<sub>3</sub>-LDHs and (NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub> may be used for the prevention of spontaneous coal combustion. The reaction mechanisms and kinetic models for NCC and GC mixed with inhibitors were also determined. Na<sub>3</sub>PO<sub>4</sub> demonstrated poor inhibiting ability in NCC and GC and even promoted the combustion of GC. Therefore, Na<sub>3</sub>PO<sub>4</sub> is not recommended as an inhibitor for NCC and GC. Finally, the results indicated that (NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub> and Zn/Mg/Al-CO<sub>3</sub>-LDHs can be used to decrease CO<sub>2</sub> release, limiting the oxidation reaction of coal and attenuating greenhouse gas emissions. This study can serve as a reference for efforts to prevent spontaneous coal combustion and for the development of new inhibitors.

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