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REMOVAL OF POLLUTANTS FROM POOR QUALITY COALS BY PYROLYSIS

ABSTRACT

Combustion of poor quality coals and wastes is used today worldwide for energy production. However, this entails significant environmental risks due to the presence of polluting compounds in them, i.e. S, N, Hg and Cl. In the complex environment of combustion these substances are forming conventional (i.e. SOx, NOx) and toxic (PCDD/Fs) pollutants, while, the highly toxic Hg is volatilised in the gas phase mainly as elemental mercury. Aiming to meet the recently adopted strict environmental standards, and the need of affordable in cost clean power production, a preventive fuels pre-treatment technique, based on low temperature carbonization, has been tested. Clean coals were produced from two poor quality Greek coals (Ptolemais and Megalopolis) and an Australian coal sample, in a lab-scale fixed bed reactor under helium atmosphere and ambient pressure. The effect of carbonization temperature (200-900°C) and residence time (5-120 minutes) on the properties of the chars, obtained after pyrolysis, was investigated. Special attention was paid to the removal of pollutants such as S, N, Hg and Cl. To account for possible mineral matter effects, mainly on sulphur removal, tests were also performed with demineralized coal. Reactivity variation of produced clean coals was evaluated by performing non-isothermal combustion tests in a TA Q600 thermogravimetric analyser. Results showed that the low temperature carbonization technique might contribute to clean coal production by effectively removing the major part of the existing polluting compounds contained in coal. Therefore, depending on coal type, nitrogen, mercury and chlorine abatement continuously increases with temperature, while sulphur removal seems to reach a plateau above 500-600°C. Moreover, the prolongation of carbonization time above 20 minutes does not affect the elemental conversion of the pollutants and carbonization at 500-600°C for approx. 20 minutes may be considered sufficient for clean coal production from poor quality coals. Clean coal production at higher pyrolysis temperatures results in observed higher initial combustion temperature, mainly due to lower volatile content in produced chars.

KEYWORDS

coal, carbonization, clean coal, pollutants removal, reactivity

PAPER SUBMITTED: 2005-11-30

PAPER REVISED: 2006-01-05

PAPER ACCEPTED: 2006-03-14

CITATION EXPORT: view in browser or download as text file

THERMAL SCIENCE YEAR 2006, VOLUME 10, ISSUE 3, PAGES [39 - 54]

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