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Retention of mercury by low-cost sorbents: Influence of flue gas composition and fly ash occurrence

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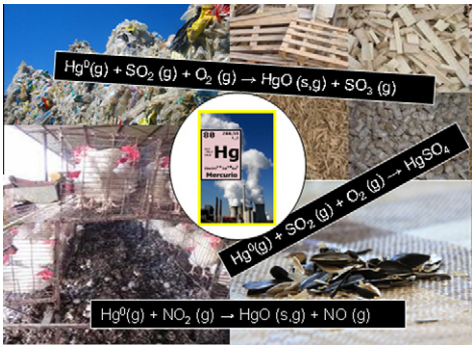
HIGHLIGHTS

- Chars from plastic-paper waste exhibit high mercury retention capacities.
- NO_2 with/without O_2 are the main factors responsible for homogeneous oxidation.
- Chars with the highest level of mercury retention show the highest heterogeneous oxidation.
- Mercury retention by the char samples is not affected by the fly ash particles.

GRAPHICAL ABSTRACT



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ABSTRACT

The present study employs chars obtained from the gasification of different types of biomass as low cost sorbents of mercury at laboratory scale. The influence of gas composition and fly ash occurrence on mercury retention and oxidation by char samples was evaluated. Chars obtained from a mixture of paper and plastic waste showed mercury retention capacities similar to those obtained with a commercial activated carbon. Homogeneous mercury oxidation was mainly promoted by NO_2 and, to a certain extend, by $SO_2 + O_2$. The highest heterogeneous mercury oxidation was observed in the chars with the highest mercury retention capacity suggesting that the sorption process also involves the capture of oxidized mercury species. The presence of fly ash particles clearly influenced heterogeneous oxidation but did not affect mercury retention by the char sorbents.

1. Introduction

On 2011 the USEPA (United States Environmental Protection Agency) proposed the first national standard to reduce mercury and other toxic air pollutants from coal and oil-fired power plants [1]. This final rule came into effect on April 16, 2012 [2]. At the same time other countries are also making considerable efforts to reduce mercury emissions and establish new legislation [3]. For example, the European Union (EU) has already made progress in addressing the global challenges posed by mercury by having it listed for consideration in the assessment and management of ambient air quality, under the European Commission's Air Quality Framework Directive (Council Directive 96/62/EC). In 2005 the European Commission launched the EU's mercury strategy which explains the EU position concerning the international discussion on mercury [4]. There is obviously a growing demand for the development of low-cost mercury removal techniques that can be implanted in coal combustion plants.

It is difficult to define the best technique for mercury capture because there are many factors to consider such as the configuration of the air pollution control devices used in the power plants and the type of coal burned [5]. Although different methods are being investigated [6–9], the injection of powdered activated

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