INFLUENCE OF OXY-FUEL COMBUSTION CONDITIONS ON MERCURY RETENTION BY FLY ASHES

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Abstract:
Carbon Capture and Storage (CCS) technology has considerable potential to reduce CO₂ emissions of the energy sector to near zero and therefore, mitigating the global warming. In this way, oxy-fuel combustion is one of the most promising CCS technologies for near-term development. During oxy-fuel combustion, a blend of oxygen and recycle flue gas is used for combustion of the fuel, generating a gas consisting mainly of CO₂ and water vapor. Under the current state of the art of this technology, some problems involving other gases associated to the process such as SOx, NOx and Hg still remain unresolved. The presence of Hg species in the flue gas of oxy-combustion processes is important for two reasons. Firstly, because mercury is a toxic element and secondly because it can amalgamate with some metals such as aluminum, damaging the CO₂ compression unit. In order to ensure the success of the large scale plants, the behavior of mercury during the oxy-fuel combustion processes have to be fully understood.

The impact of fly ash samples on mercury speciation was evaluated by using a laboratory scale device. Different fly ash samples from a circulating fluidized bed (CFB) oxifiring plant were examined. The experiments were conducted at 150 ºC. The mercury retention capacity and efficiency was determined. The impact of morphological characteristics of the fly ash and chemical flue gas composition on mercury adsorption and oxidation was assessed. A continuous Hg analyzer for gases (VM 3000) was used to monitor Hg⁰. The content of Hg(II) species in the flue gas was determined by capturing them in an selective ion exchanger resin (Dowex® 1x8), especially designed for the selective extraction of Hg(II) species. The total content of Hg⁰ and Hg(II) adsorbed in the fly ashes was determined by an automatic mercury analyzer (AMA 254).

A comparison between mercury retention by fly ashes in CFB combustion in air and in oxy-fuel processes was carried out in order to establish the main differences.

Keywords: mercury, oxy-fuel combustion, fly ash.

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