USING UNBURNED CARBON DERIVED SORBENTS FOR CO_2 CAPTURE

M. Mercedes Maroto-Valer*, Zhe Lu, Yinzhi Zhang and John M. Andrésen

Department of Energy and Geo-Environmental Engineering and The Energy Institute, The Pennsylvania State University, 405 Academic Activities Bldg, University Park, PA 16802

*Presenting author: Ph: 814-863-8265, Fax: 814-865 3248, e-mail: mmm23@psu.edu

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ABSTRACT

Although coal is the most abundant fossil fuel in the US, the reduction of CO_2 emissions from coal-fired units is an imperative to mitigate global climate change, and consequently, to guarantee the sustainable key role of coal in the 21st century. The costs of separation and capture of CO_2 are estimated to be about three-fourths of the total cost of ocean or geological sequestration, where the processes involved are very energy intensive and the amine solutions used in the process have very limited lifetimes. Recently, new solid based sorbents are being investigated, where the amine groups are bonded to a solid surface, resulting in an easier regeneration step. However, the supports used thus far, including commercial molecular sieves and activated carbons, are very expensive and hinder the economical viability of the process. Therefore, there is a need to find cost-effective precursors that can compete with expensive commercial sorbents. For these new precursors to compete effectively with commercial sorbents, they must be inexpensive, and be easily converted into high-surface materials. The unburned carbon in the fly ash meets satisfactorily all these conditions. Firstly, it can be easily obtained from the utility industries as a byproduct. Secondly, the conventional production of activated carbons consists of a two-step process, that includes a devolatilization of the raw materials, followed by an activation step. In contrast, for unburned carbon only a one-step activation process is required, since it has already gone through a devolatilization process while in the combustor. Accordingly, this work focuses on the development of fly ash derived sorbents to capture CO_2 from flue gas of power plants.