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PII: S1385-8947(18)31098-2
DOI: https://doi.org/10.1016/j.cej.2018.06.060
Reference: CEJ 19271

To appear in: *Chemical Engineering Journal*

Received Date: 11 May 2018
Revised Date: 8 June 2018
Accepted Date: 10 June 2018

Please cite this article as: S.J. Thompson, M. Soukri, M. Lail, Phosphorous Dendrimer Bound Polyethyleneimine As Solid Sorbents for Post-Combustion CO_2 Capture, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.06.060

Phosphorous Dendrimer Bound Polyethyleneimine As Solid Sorbents for Post-Combustion CO_2 Capture

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ABSTRACT: High capacity solid amine sorbents for CO_2 adsorption were prepared via a cross-linking reaction between polyaldehyde phosphorous dendrimers and polyethyleneimines (PEIs). The best performing sorbent achieves an average CO_2 capacity of 13.1 wt.% through 350 cycles of adsorption/desorption over 700 contiguous hours from simulated flue gas conditions (CO_2, O_2, H_2O, and N_2). The adsorption operates with relatively high capacities and rapid kinetics between 25 – 85 °C, reaching 90% capacity within the first 10 minutes of exposure at 65 °C. The capture of CO_2 in the presence of common acid gas contaminants (SO_2, NO, and NO_2) and from sour gas (10,000 ppm H_2S) was also demonstrated. The heat of adsorption and other physical properties (e.g. surface area, pore volume, and SEM) were measured and disclosed.

KEYWORDS: Solid Sorbent, Carbon Capture, Phosphorous Dendrimer, Post Combustion CO_2 Capture, CO_2 Solid Sorbent.

1. Introduction

Measures to reduce the release of carbon dioxide (CO_2) from small and large-scale emission sources are being undertaken on a world-wide scale. Capturing CO_2 from large industrial facilities, which contribute up to 60% of the global emission, is of the upmost importance to effectively combat climate change [1]. Over the past few decades, significant advances have been achieved in technologies for Carbon Capture and Sequestration (CSS). Specifically, materials composed of amine compounds have been proven effective for adsorbing CO_2 from concentrated post-combustion streams (e.g. flue gas) and have been successfully implemented at large scales [2–4].