Carbon Dioxide (CO_2) Capture Using a Novel Microjet and Vibration Assisted (MVA) Fluidized Bed

Brenda Villa, Chemical Engineering
Mentor: Dr. Jean M. Andino
School for Engineering of Matter, Transport and Energy

Research question: How will the fluidization process, when changing between vibration alone, microjet assistance alone, and combined microjet and vibrational assistance, change the efficiency of CO_2 capture?

Introduction

- Fluidization of an adsorbent is used to improve carbon dioxide (CO_2) capture.
- A novel Microjet and Vibration Assisted (MVA) fluidized bed[2] supplements the fluidization capability of nanosized particles.
- Vibration and microjet assistance applied in a fluidized bed can enhance CO_2 capture [1] while being cost effective.

Goals

- Utilize microjet/vibration functions of the MVA fluidized bed, each at different times, to obtain optimal CO_2 adsorbance
- Improve sustainability by utilizing $CaOH_2$ for the capture of air pollutants in CO_2 capture

Methods

Experimental Conditions

- High Purity $N_{2\,(g)}$ is used to fluidize the bed at 0.005 to 0.035 m/s
- $CaOH_2$ will fluidized in a column reactor[3]

Methods and Materials

- Pressure drop: Pressure manometer (RISEPRO HT-1890) [2]
- Electromagnetic vibration: Single generator (Cleveland Vibrator Co. VAF-3) [2]
- Frequency and amplitude: (PCE Instruments #PCE-VT 2700) [2]
- Gas flow rate: mass flow controller (MFC) [2]
- $CaOH_2$ nano powder

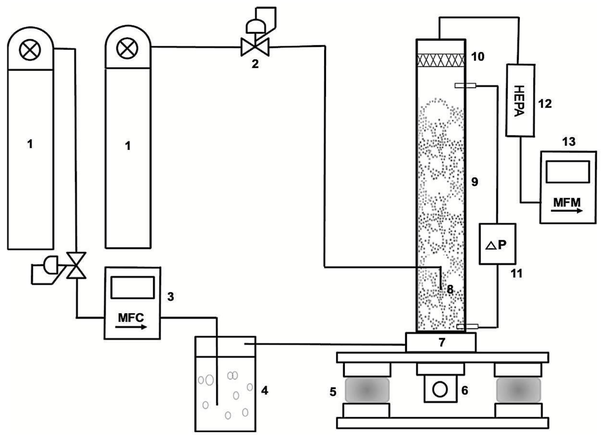

Figure 1. Schematic diagram of the experimental setup. 1. Compressed N_2 Cylinder, 2. Pressure regulator, 3. Mass flow controller, 4. Water bubbler, 5. Vibration isolator, 6. Magnetic vibrator, 7. Gas distributor, 8. Microjet, 9. Fluidization reactor, 10. Pre-Filter, 11. Pressure manometer, 12. HEPA Filter, 13. Mass flow meter. [2]

Design Process

- A dry process permits lower costs, simpler disposal of the used sorbent, and simpler configuration as compared to a wet scrubber
- Less heat might be required for solid regeneration as opposed to CO_2 wet scrubbing.
- Thermal/chemical stability of regenerable calcium-based sorbent provides 95% regenerative efficiency [3]
- A 3-stage fluidized bed with porous granular calcium oxide particles provides 71% CO_2 adsorbing efficiency[4]

Future Results

- It is expected that the MVA system outperforms a VFB system[5], due to differences in bed height (Figure 2)
- Confirm the use of $CaOH_2$ sorbent is efficient in CO_2 capture
- Implement system in high CO_2 release locations such as powerplants

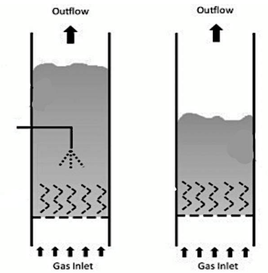

Figure 2: Bed Height Comparison for a Microjet and Vibration Assisted (MVA) and Vibration Fluidized Bed (VFB) [2]

References

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Acknowledgements

The author gratefully acknowledges the Fulton Undergraduate Research Initiative (FURI) for research funding, and mentorship by Drs. J.M. Andino and K. An.

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Ira A. Fulton Schools of Engineering
Arizona State University