Transformational Sorbent-Based Process for Direct Air Capture

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Dr. Ravi Jain
InnoSepra, LLC

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Project Overview

- Total DOE funding: $246,000
- Partners: InnoSepra, DOE and material suppliers
- Overall project objectives are to demonstrate the potential for a significant reduction in the cost of CO₂ capture directly from air based on lab scale testing and a techno-economic analysis
Technology Background

- Based on physical sorbents in structured form
- High CO₂ capacity at a p_{CO₂} of 0.04 kPa (>4-wt%), low heats of adsorption (40-44 kJ/mol of CO₂)
- Materials are low cost, easily scalable to quantities needed for commercial use (thousands of tons), very stable (>5 year life)
- Challenges include fabrication of large quantities in structured form, process demonstration at a commercially relevant scale
Technical Approach/Project Scope

Work Plan
• Materials procurement, fabrication of lab test units
• Measurement of CO$_2$ sorption/desorption isotherms (0 to 100$^\circ$C)
• Moisture removal testing (up to 8 Nm$^3$/hr), CO$_2$ capture testing (up to 1.5 Nm$^3$/hr)
• Techno-economic analysis – ~100 tons/day CO$_2$ captured

Key Milestones
• Completion of lab testing – 1/31/21
• Completion of techno-economic analysis – 3/31/21

Project Success Criteria
• Techno-economic analysis showing a potential CO$_2$ capture cost of <$200/tonne after successful scale up
Team and Facilities

- DOE Project Manager: Mr. David Lang
- The InnoSepra Team (shown above), not shown Dr. Norberto Lemcoff, Dr. Stevan Jovanovic, Mr. Robert Ferrell
- Key equipment includes sorption microbalance, test units
Current Status of the Project

- Obtained materials for isotherm measurements, breakthrough and cyclic testing
- Built experimental units for moisture removal and CO₂ capture testing
- Measured CO₂ sorption/desorption isotherms at 0-100°C
  - More than 4.5-wt% capacity at a pₐₐ₉ of 0.04 kPa (400-ppm CO₂ in air)
- Moisture removal to below <1,000 ppm with a very low pressure drop
- A cyclic CO₂ capacity of about 4-wt% with 400-ppm CO₂ in N₂, no sorbent degradation
- The performance is on target for a low cost DAC process
Opportunities for Collaboration

• The technology can be demonstrated quickly at scale through a synergistic combination of
  • Large scale fabrication of CO\textsubscript{2} capture materials
  • Fabrication and testing of the capture equipment incorporating capture materials in structured form at >2,000 Nm\textsuperscript{3}/hr scale

• InnoSepra would welcome opportunities to work with:
  • Companies involved in the fabrication of structured sorbents
  • Engineering companies for process scale up
  • Independent organizations involved in techno-economic analysis of Direct Air Capture
  • Companies interested in scale-up testing
  • Investors / business partners

ravi.jain@innosepra.com