TECHBRIEF

SINGLE-STEP SYNTHESIS OF CARBON CAPTURE FIBER SORBENTS

OPPORTUNITY:

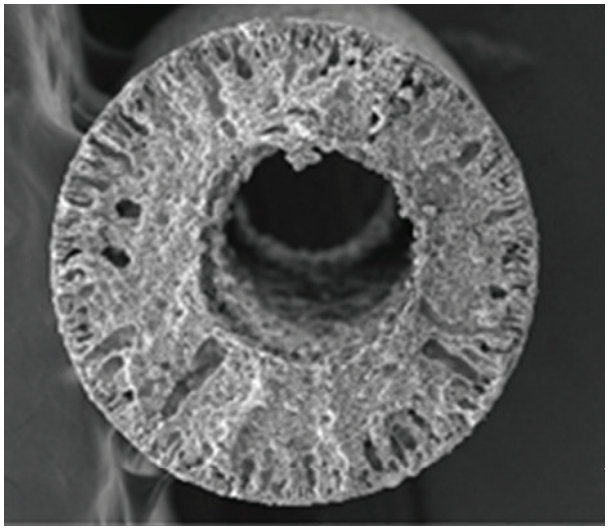
This invention describes a single-stage preparation of a novel carbon capture fiber sorbent. This technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

CHALLENGE:

Conventional pressure- or temperature-swing adsorption (PSA/TSA) processes have been widely considered for post-combustion carbon capture and direct air capture (DAC). However, the processes of pressurizing the flue gas in the case of PSA or the long regeneration time in the case of TSA are considered neither cost-effective nor energy efficient, which limit their use in large-scale carbon capture processes. Furthermore, the high heat released during carbon dioxide (CO_2) adsorption onto conventional sorbent amine sites necessitate efficient heat redistribution away from the sorbent bed and back into the overall carbon capture process. Therefore, a low-cost and energy efficient carbon capture process that could be retrofitted onto existing power plants is needed.

OVERVIEW:

This invention was based on incorporating crosslinked amine-based basic immobilized amine sorbent (BIAS) within a porous polymer fiber network for use in a rapid TSA carbon capture system. This invention has several unique features not found with traditional pallets, flat-sheet or fiber polymer membranes. The BIAS sorbent is easily manufactured and physiochemically stable; highly loaded within the fiber (up to 85%); and allows fast CO_2 mass transfer to the sorbents, due to the porous structure with large pore size of the hybrid organic-inorganic fiber matrix. The synthesis procedure is a single-stage, direct-spinning process, which is highly scalable.



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ADVANTAGES:

- Effective heat integration and redistribution process engineered to give improved performance over liquid sorption systems.
- High treated gas volumes and fast cycle times.
- Minimal contact with high-temperature steam, mitigating sorbent degradation to ensure long-term stability.
- Scalable sorbent and fiber manufacturing protocols.

APPLICATIONS:

- Post-combustion carbon capture systems.
- DAC systems.
- Landfill and other biogas systems.

PATENT STATUS:

U.S. Patent Pending (non-provisional patent application)

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Title: Single-Step Synthesis of CHEmisorption Fiber Sorbent (CHEFS) for Capture of CO_2 and Removal of Water Contaminants

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