Organic Polymers with Ultra-Small Pores for Carbon Dioxide Separation, Capture, and Conversion

WiSys: T160005US02

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WiSys is seeking a strategic partner that operates in the field of carbon capture who is interested in accessing WiSys' novel organic polymers with ultra-small pores for use in the sequestration and/or utilization of carbon dioxide from gas mixtures. WiSys is also seeking a partner to assist in the continued development of membranes that incorporate the novel organic polymers.

Overview

According to the EPA, as of 2015 carbon dioxide and methane comprise about 82% and 10% respectively of greenhouse gas emissions resulting from human activities. Landfill gas is a considerable source of both carbon dioxide and methane. When the organic matter in landfills is biologically decomposed under aerobic and subsequent anaerobic conditions, the end result is roughly a 50/50 mixture of carbon dioxide and methane gases. Rather than releasing this mixture into the air, the landfill gas compounds can be collected and converted (carbon dioxide) to useful chemicals or used (methane) as a natural gas energy source. While methods do exist to separate CO2 from the 50/50 mixture including the use of amine scrubbers and cryogenic phase change processes, such methods are inefficient, difficult to handle, and capital intensive. As such, there is an unmet need for the development of a more efficient method and system for removing CO2 from other gases such as methane and isoprene, providing for a useable gas stream for energy production.

The Invention

Researchers at the University of Wisconsin – Platteville have synthesized an array of chemically and thermally stable organic polymers comprised of ultra-small pores capable of separating out and capturing carbon dioxide molecules from a mixture of gases. These include phenazine linked polymers (PLPs), glyoxal - derived polymers (GDPs), benzoxazole - linked polymers (BOLPs), and benzothiazole - linked polymers (BTLPs) with each having nitrogen-rich functionality to attract CO2. The single component adsorption isotherms demonstrated that the polymers have exceptionally high CO2 capture ability over CH4 and N2 with maximum adsorption selectivity of 35 times greater and 140 times greater, respectively, at 25°C. Such polymers have utility in the formation of membrane composites for use in membrane gas separation technology. Additionally, the researchers have been able to combine these polymers with silver metal resulting in the catalytic conversion of carbon dioxide molecules to useful chemical compounds.

Applications

- Separation of carbon dioxide from gas mixtures such as landfill gas, natural gas, or flue gas
- Conversion of carbon dioxide molecules into useful chemical compounds.

Key Benefits

- Membrane technology that does not require gas-to-liquid phase change and thus reduces sizable energy and capital costs when compared with competing separation technologies
- The structures of the pores can be nitrogen-rich, sulfur-rich, oxygen-rich, or a combination of the aforementioned
- Polymers can be synthesized from inexpensive commercially available compounds or through easy synthetic routes.

Stage of Development

Researchers at the University of Wisconsin – Platteville have synthesized an array of chemically and thermally stable organic polymers comprised of ultra-small pores capable of both separating out and capturing carbon dioxide molecules from a mixture of gases. Additionally, the researchers have been able to combine these polymers with silver resulting in the catalytic conversion of carbon dioxide molecules to useful chemical compounds. Current studies are ongoing to continue developing these polymers and using them to make membrane composites as well as alternative approaches for separating gasses within a mixture. Additional testing is also needed outside of a laboratory setting with real world landfill gas mixtures.

Tech Fields

- Clean Technology : Monitoring, remediation & waste reduction
- Materials & Chemicals : Composites

For current licensing status, please contact Jennifer Souter at jennifer@wisys.org or (608) 316-4131