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Membrane Contactor for Simultaneous Desalination and Co2 Removal From Seawater

Background

To address the pressing issue of climate change resulting from excessive CO2 levels in our atmosphere, an array of innovative negative emission technologies must be scaled and implemented for carbon removal. Discussions concerning these technologies often surround Direct Air Capture (DAC); however, Direct Ocean Capture (DOC) is an exciting approach to negative emissions, as aqueous environments allow carbon-based species to exist in much higher concentrations. As a result, the ocean contains a nearly 150 times higher volumetric concentration of CO2 than the air, presenting an unprecedented opportunity to capture high volumes of carbon via DOC. A significant barrier to DOC, however, is the need to move substantial volumes of water at once, which is traditionally an energy intensive and expensive process.

Invention Description

Researchers at Arizona State University, University of Pittsburgh, and University of California Irvine have developed a novel membrane contactor that can simultaneously remove CO2 from seawater and perform desalination. While current systems only desalinate the water, this technology integrates Direct Ocean Capture (DOC) with existing large-scale infrastructure via Seawater Reverse Osmosis (SWRO) plants, enabling the synergistic co-production of clean drinking water and CO2 for storage with a single membrane. This device enables carbon capture from seawater by electrochemically lowering the pH of water at the membrane surface, converting dissolved bicarbonate ions (HCO3-) to gaseous CO2. This CO2 can be extracted and stored elsewhere, providing an efficient and cost-effective alternative to direct air capture while simultaneously managing climate change and changing ocean pH levels.

Potential Applications

- Removal of CO2 from seawater
- Seawater pH regulation
- Alternative to Direct Air Capture (DAC) removal

Benefits and Advantages

- Cost and energy savings
- Simultaneous carbon capture and desalination