Docket #: S25-008

Removing Methane From Air by Bubbling Air Through Saltwater

Methane (CH4), a potent greenhouse gas with 25 times the thermal impact of carbon dioxide (CO?), contributes to about 30% of global warming since the Industrial Revolution. Developing an efficient and cost-effective method to remove methane from the atmosphere is crucial for achieving sustainability goals. The Stanford team has proposed a novel approach: Partial Oxidation of Methane (POM) to methanol, which not only mitigates emissions but also generates valuable chemical products.

This process involves forming methane-air microbubbles (20-40 ?m) in saltwater and applying an alternating electric field drive using a copper oxide foam electrode. Dissolved salts (KCl or NaCl at 3%) enhance methane solubility, enabling more effective reactions at the gas-water interface. By fine-tuning drive frequency and amplitude, methanol selectivity exceeds 90%, with minimal byproduct formation. The methane-to-methanol conversion yield reaches 57%, with a production rate of ~887 ?M h?[1].

This method offers an innovative solution for methane removal using seawater and presents opportunities for converting concentrated methane sources into value-added methanol, addressing both environmental and industrial needs.

Stage of Development: Prototype

Applications

- Greenhouse gas (Methane) removal

Advantages

- Superior to electrochemistry or photochemistry methods
- High selectivity (exceeds 90%)
- Value-added end product: methane to methanol conversion

Publications

- SF Nami-Ana, MA Mehrgardi, M Mofidfar, RN Zare (2024). Sustained Regeneration of Hydrogen Peroxide at the Water–Gas Interface of Electrogenerated Microbubbles on an Electrode Surface. *Journal of the American Chemical Society*, *146*(46), 31945-31949.

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