Docket #: S21-245

Infrared Spectroscopy of Carbon Dioxide Hydration

Measurement of dissolved CO_2 has critical applications in healthcare monitoring and consumer goods quality control, yet is difficult to measure directly. Common methods include titration, measuring off-gas pressure, electrical conductivity or calculating chemical equilibria, all of which require a secondary calculating to determine the concentration of dissolved CO_2. Here researchers in the Dai lab have developed an infrared (IR) spectroscopy technique that allows them to overcome the typical challenge of CO_2 peaks being overshadowed by water. This ~100 micron IR cell creates a thin film of solution where the water does not absorb all the light, allowing the CO_2 signal to be resolved and quantified. This configuration tolerates high pressure systems (up to 58 atm) and still allows for clear CO_2 quantification. From CO_2 capture to consumer drinks and healthcare monitoring via dissolved CO_2 in blood, this technique provides a reliable, accurate and direct method for in situ measurement of dissolved CO_2.

Stage of Research

- Prototype

Applications

- Quantitative analysis of dissolved CO_2
- Consumer drinks: quality control and changing taste profiles of carbonated drinks
- Healthcare: measuring CO_2 levels in blood

Advantages

- Direct, in situ measurement of dissolved CO_2 vs measuring the gaseous phase and solving equilibria equations
- Capable of measuring high pressure or time-dependent systems

Publications

- Li, Jiachen, Jinyu Guo, and Hongjie Dai. "Probing dissolved CO2 (aq) in aqueous solutions for CO2 electroreduction and storage." *Science advances* 8.19 (2022): eabo0399.

Patents

- Published Application: WO2023069453

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