Development of a Small CO_2 Capture Device for Educational Use and Democratization of Direct Air Capture with a View to Application and Development to ECLSS

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Climate engineering research occupies an essential position in climate change countermeasures, among which CO_2 removal technology is indispensable as a fundamental solution to climate change. Since the concentration of CO_2 in the Earth's ambient atmosphere is highly dilute (around 400 ppm), the efficiency of CO_2 capture is low, and various universities, large companies, and start-ups have been tackling research and development on direct air capture (DAC) around the world. However, the recognition of DAC in Japan still needs to improve, and the authors have been working on developing the world's smallest educational CO_2 capture device to promote individual awareness. The system is a suitcase-sized device that democratizes CO_2 recovery, allowing the general public to access DAC technology at the push of a button. The method of CO_2 recovery is chemical absorption, and various solutions such as NaOH, KOH, and amines can be selected. The most distinctive feature of this system is the CO_2 absorption unit, which has a structure that maximizes the specific surface area of contact between the solution and air, resulting in CO_2 recovery efficiency of up to 84 %, comparable to large DAC systems. On the other hand, developing elemental technologies related to Environmental Control and Life Support System (ECLSS) is significant when considering human habitation in space or on other planets, and the miniaturization of Carbon Dioxide Removal (CDR) system will contribute to expanding the space available for habitation. In this presentation, we introduce the CO_2 recovery system, efforts to promote its use, and research on utilizing the recovered CO_2.[1]

[1] Muraki, K. Development of a CO_2 Recovery System for Educational Use and Methane Conversion Reaction using Mechanochemical Method. 4th Symposium of the New Energy and Hydrogen Division, The Japan Institute of Energy (2020).