Tohoku Univ. Technology

Enhanced CO_2 Geological Storage and Mineralization Using Rock Dissolution by Biodegradable Chelating Agents

Safe, Secure, and Efficient CCS: A Key to Decarbonization

Overview

In recent years, CO_2 geological storage using mafic and ultramafic rocks—such as basalt and peridotite, which are rich in calcium and other metal elements that react with CO_2 to form carbonate minerals—has garnered global attention as a means of reducing atmospheric CO_2, a major contributor to global warming. However, subsurface environments for CO_2 storage are typically low in temperature and therefore have limited reactivity. Additionally, the amount and connectivity of pores as well as permeability of the subsurface rocks are not always sufficient, presenting significant challenges that require innovative technological solutions.

In storage methods that involve dissolving CO_2 in water, the use of seawater is preferable. However, during the storage process, it is also necessary to temporarily suppress the reaction between metal ions in seawater and CO_2 until the CO_2 is securely stored.

This invention promotes CO_2 geological storage and mineralization by using biobased, biodegradable chelating agents that enhance mineral dissolution and capture metal ions. By dissolving minerals in subsurface rocks using the chelating agents, the amount and connectivity of pores (CO_2 storage capacity) increase, and the permeability (CO_2 injectivity) is also improved. Furthermore, when CO_2-charged seawater containing the chelating agents is injected into subsurface rocks, it becomes possible to simultaneously store both CO_2 and the metal ions required for carbonate mineral formation with creating additional rock porosity.

Product Application

- ☐ Geological storage of hydrogen
- ☐ Development of natural hydrogen resources

IP Data

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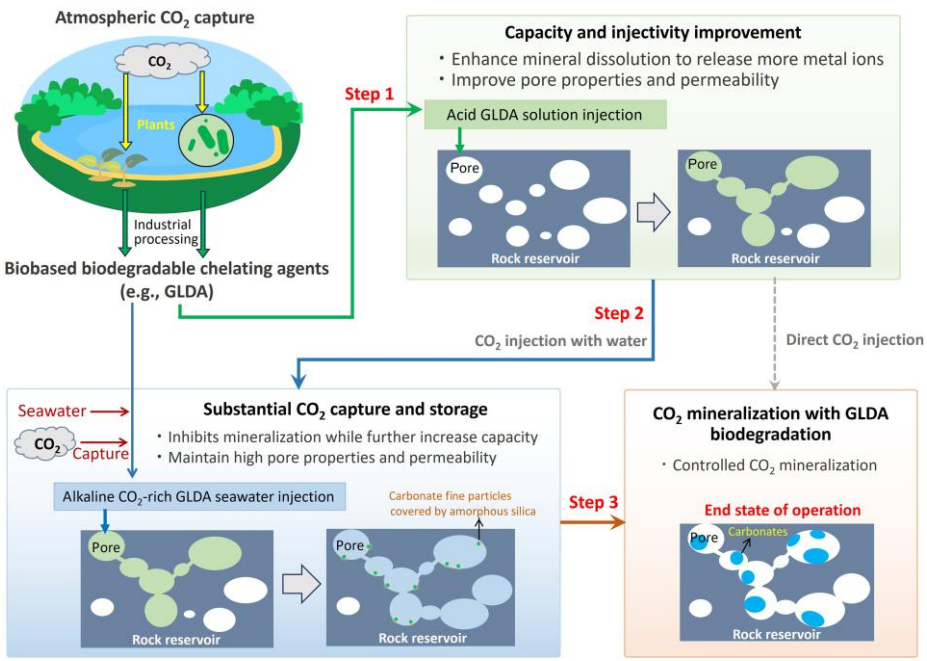
Concept of CO_2 Geological Storage and Mineralization Enhancement Technology



Related Works

[1] Wang et al. , CO_2 capture, geological storage, and mineralization using biobased biodegradable chelating agents and seawater. *Sci.Adv.***10**, eadq0515(2024). DOI:10.1126/sciadv.adq0515

[2] Tohoku University Press Release "Invention of a CO_2 Reduction Technology Using Plant-Based, Biodegradable Materials — Making CO_2 Geological Storage and Mineralization Safer, More Secure, and More Efficient —“ https://www.tohoku.ac.jp/japanese/2024/11/press20241118-01-co2.html

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