NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE | Nanyang Environment and Water Research Institute

CO_2 CAPTURE: CO_2 MINERALIZATION AND CARBONATES PRODUCTION WITH THE STREAMS OF CA AND MG CONTAINING INDUSTRIAL BY-PRODUCTS

Abstract:

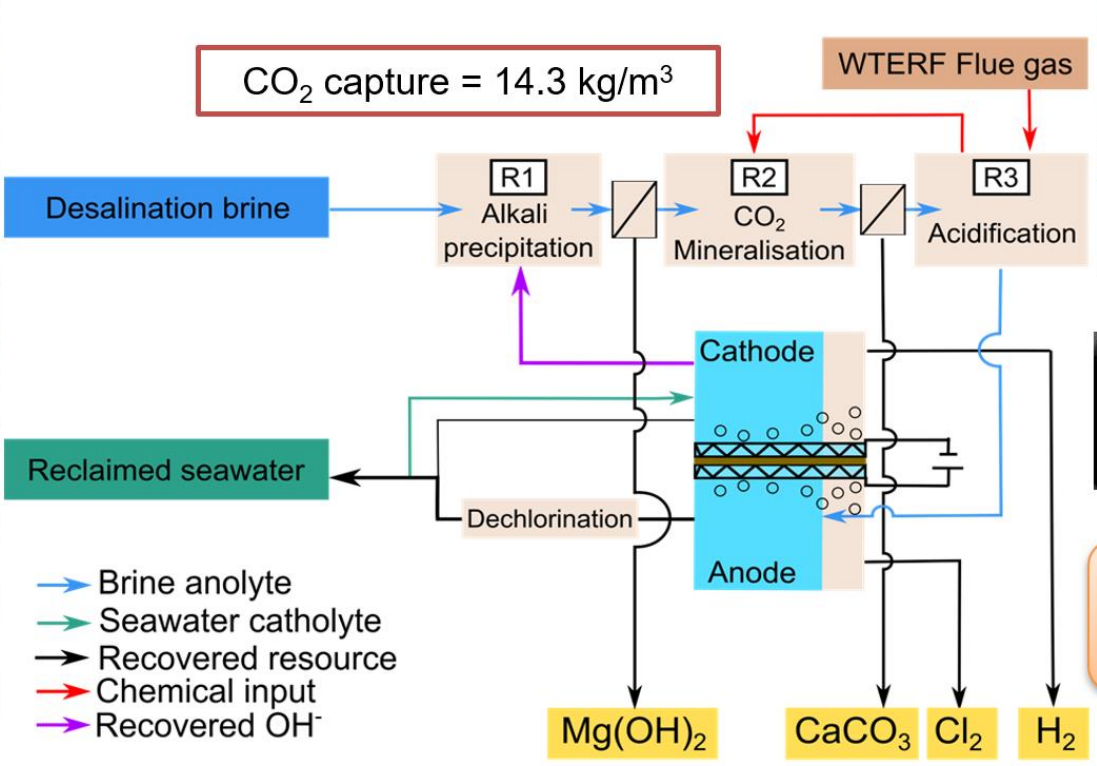
The releasing of CO_2 into the atmosphere is one of the major causes of global warming. Although the natural carbon cycle in the ocean is insufficient at capturing the current global CO_2 emission rate, it is possible to artificially enhance the ecological process through CO_2 mineralization. CO_2 mineralization is a carbon capture and storage technique which traps CO_2 in the form of carbonate. Mineral carbonates are thermally stable, trapping CO_2 for at least 10,000 years. In particular, Group II cations from desalination brine (387,224,000 m^3/a discharge in Singapore) or industrial waste brine can be used to immobilize carbon as solid carbonates.

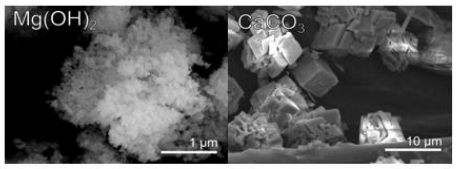
The realizability of CO_2 mineralization technology therefore lies in the alkali source, with one source of alkali sourced from electrochemical processes. Hence, NTU proposes using industrial waste brines to trap CO_2 from industrial waste gases (estimated at 14.3 kg CO_2/m^3). This project uses the established chlor-alkali process to generate carbonate solutions from industrial CO_2 gas stream and use these minerals in construction materials like concrete. Other valuable products produced generated include magnesium hydroxide, hydrogen, and chlorine, providing additional value for the CO_2 mineralization process. The resulting brine is electrochemically desalinated, providing a safer discharge for the environment.

The optimized system will be built into an integrated prototype system for both lab scale and demonstration scale at the waste to energy plant, paving the pathway to develop large-scale CO_2 mineralization facilities.

Discharge: 387,224,000 m^3/y

Lab-scale prototype





Alternative feedstock and treated products will be considered

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