



## Biocatalytic CO<sub>2</sub> sequestration based on shell regeneration

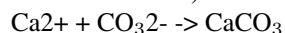
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Carbon dioxide, CO<sub>2</sub>, is one of the green gases, being uniformly distributed over the earth's surface. Recently, a variety of methods exists or has been proposed for pre- or post-emission capture and sequestration of CO<sub>2</sub>. However, CCS (carbon capture & storage) do not guarantee permanent treatment of CO<sub>2</sub> and could ingenerate environment risks.

Some organisms convert CO<sub>2</sub> into exoskeleton (e.g., mollusks) or energy sources (e.g., plants) during metabolism under atmospheric conditions. One of representative biomaterials in ocean is bivalve shell to be composed of CaCO<sub>3</sub>. Calcium carbonate is not only abundant material in the world but also thermodynamically stable mineral in the capture of CO<sub>2</sub>.

Bivalve has produced CaCO<sub>3</sub> under seawater condition, in other word, near atmospheric conditions (1 atm. and around 20-25 oC). At the inorganic point, the synthesis of CaCO<sub>3</sub> is as followed.



The bivalve shell plays an important role to protect bivalve's internal organs from predator. What will be happened if the shell is damaged and a hole is made? Bivalve must cover the hole to prevent the oxidation of internal organs as fast as possible. From in vitro crystallization test of a notched shell, rapid CaCO<sub>3</sub> production was identified at the damaged area. The biocatalyst related to shell regeneration was purified and named as SPSR (Soluble Protein related to Shell Regeneration) that is obtained from the oyster, *Crassostrea gigas*. And in vitro CaCO<sub>3</sub> crystallization test was used to calculate the crystal growth rate of SPSR on CaCO<sub>3</sub> crystallization. The characteristics of SPSR are discussed at the point of CO<sub>2</sub> hydration and rapid CaCO<sub>3</sub> synthesis. To develop the bioinspired process based on shell regeneration concept, the analysis of protein structure has been studied and the immobilization has been carried out for easy recovery of SPSR.