



Biocatalytic CO₂ sequestration based on shell regeneration

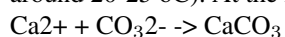
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Carbon dioxide, CO₂, is one of the green gases, being uniformly distributed over the earth's surface. Recently, a variety of methods exists or has been proposed for pre- or post-emission capture and sequestration of CO₂. However, CCS (carbon capture & storage) do not guarantee permanent treatment of CO₂ and could ingenerate environment risks.

Some organisms convert CO₂ 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 CaCO₃. Calcium carbonate is not only abundant material in the world but also thermodynamically stable mineral in the capture of CO₂.

Bivalve has produced CaCO₃ under seawater condition, in other word, near atmospheric conditions (1 atm. and around 20-25 oC). At the inorganic point, the synthesis of CaCO₃ 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 CaCO₃ 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 CaCO₃ crystallization test was used to calculate the crystal growth rate of SPSR on CaCO₃ crystallization. The characteristics of SPSR are discussed at the point of CO₂ hydration and rapid CaCO₃ 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.