Basic studies on the system for decreasing atmospheric CO_2 by means of calcaerous and halophilic algae and analysis of the properties of halotolelant carbonic anhydrase

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Summary

A laboratory-size-model-system for increasing biological fixation of atmospheric CO_2 by marine algae was planned to develop. The principle of the method is increasing $CaCO_3$ deposition by unicellular calcaerous algae which have no or less carbonic anhydrase (CA) activity by means of a halotolerant carbonic anhydrase of *Dunaliella* cells. Necessary basic data on the calcaerous algae and the CA were accumulated in this study.

1) Optimum pH and temperature for photosynthesis and growth of coccolithophorids were 8-8.5 and 25°C, respectively.

2) The rate of algal growth was strongly affected by O_2 because of its high sensitivity of photosynthesis to O_2.

3) *Dunaliella tertiolecta* was found to have both intra- and extra-cellular CAs. At the same concentration of NaCl used in the culture medium (0.5 M), the extracellular CA was activated, while the intracellular one was slightly inhibited. The enhancement was the effect of Cl^-, but not Na^+. This enhancement is in a marked contrast to the other CAs, such as in fresh water algae, which are sensitive to Cl^-.

4) The other *Dunaliella* species which are able to grow at higher salinity, such as *D. salina, D. viridis* and *D. parva*, had mainly internal CA which is sensitive to NaCl.

5) Activation of the CA activity by Cl^- was suggested to be due to a conformational change of enzyme structure.