Physiological studies on the salinity-dependent growth of the red-tide flagellate *Heterosigma akashiwo*.

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Summary

The marine raphidophycean flagellate *Heterosigma akashiwo* is abundant in the temperate coastal water of Japan and known to be the dominant species in red tides. When considering the mechanisms of the occurrence of red tides, *H. akashiwo* can be a good model for the physiological studies. Moreover the laboratory-size culture of this alga is effortless compared to those of other red-tide species.

The growth was revealed to be affected with the salinity of media. The highest growth rate was given when the cells were grown in the medium with the salinity of 18 ‰. Simultaneously, the highest rates of photosynthetic O_2 evolution and photosynthetic CO_2 assimilation, 165 μmol O_2 • mg Chl a^{-1} h^{-1}, 191 μmol CO_2 • mg Chl a^{-1} h^{-1}, respectively, were observed. Effect of salinity on the growth would partially be ascribed to its effect on photosynthesis.

The synthesis and degradation of the molecules of nitrate reductase that catalyzes the first step of nitrate assimilation were revealed to be regulated by light. Nitrate reductase was synthesized by light and completely degraded when the cells were transferred to darkness. The light intensity that was sufficient for the induction of nitrate reductase was comparable to those of photosynthetic CO_2 assimilation. The induction was completely inhibited by the addition of 10^{-5}M of dichlorophenyldimethylurea (DCMU), an inhibitor of photosynthetic electron transport system. Clearly, photosynthetic carbon and nitrate assimilation pathways are synchronously operated in *H. akashiwo*.

Various enzymatic activities that compose C_3 photosynthetic carbon cycle and C2 photorespiratory carbon cycle, TCA cycle, and nitrate assimilation pathway were not affected by alteration of salinity in culture media. Thus the effect of salinity on the growth of the cells of *H. akashiwo* would be attributed to photosynthetic electron transport system rather than any metabolic pathways that constitute early stage of photosynthetic carbon and nitrate assimilation.