Proc NIPR Symp. Polar Biol., 5, 174–176, 1992

SOME INTERESTING PROBLEMS OF ANTARCTIC LIMNOLOGY WITH SPECIAL REFERENCE TO THE ALLELOPATHIC EFFECTS ON THE ALGAL ECOLOGY (EXTENDED ABSTRACT)

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The occurrence and distribution of algae in Antarctic inland waters are mainly limited by extreme low temperature and peculiar light-dark rhythm in the Antarctic environment. The development of the algal vegetation is also closely related to the water quality, particularly of the levels of content of nutrient salts. Additionally, in the case of small closed habitat, the biotic interaction such as allelopathic effect is also possibly one of the effective determinants in the structure and composition of Antarctic algal communities.

It is well known that angiosperm metabolites and their decomposed substances frequently act on other plants as allelopathic agents (RICE, 1984). The antialgal activity of Antarctic terrestrial plants such as certain species of mosses and lichens has been reported (AKIYAMA *et al*, 1988, 1989), and in the case of algal epiphytes and moss plants, it was recognized that both the number of epiphytic species and the quantity of algal biomass are closely related to the allelopathic potential indicated by paper-disc test of host moss plants

The antialgal effect caused by the presence of acrylic acid and oxalic acid of penguin excrements and the soil extracts of penguin rookeries on the algae has also been demonstrated (AKIYAMA *et al*, 1986a, b) A similar antialgal effect of an inland water obtained from a small pond located near the penguin rookery was recognized Figure 1 shows the nutrient salts contents and the relative algal growth potential (AGP) of several small temporary ponds which originated from the melted water of snow drift distributed in the fluvioglacial channel near the Lake Richardson, Enderby Land, East Antarctica In spite of the eutrophicated condition of pond A water, the algal growth potential of this pond water was not very high compared with that of other oligotrophic ponds (Fig. 1, B–F)

In another experiment, it was demonstrated that the growth of *Chlorella* sp. in the culture medium based on the C18 treated (passed through a lipophilic column made of octadecyl silane) filtrates of pond A water was evidently better than that of non-treated control (Fig. 2). This apparently indicates the presence of an allelopathic

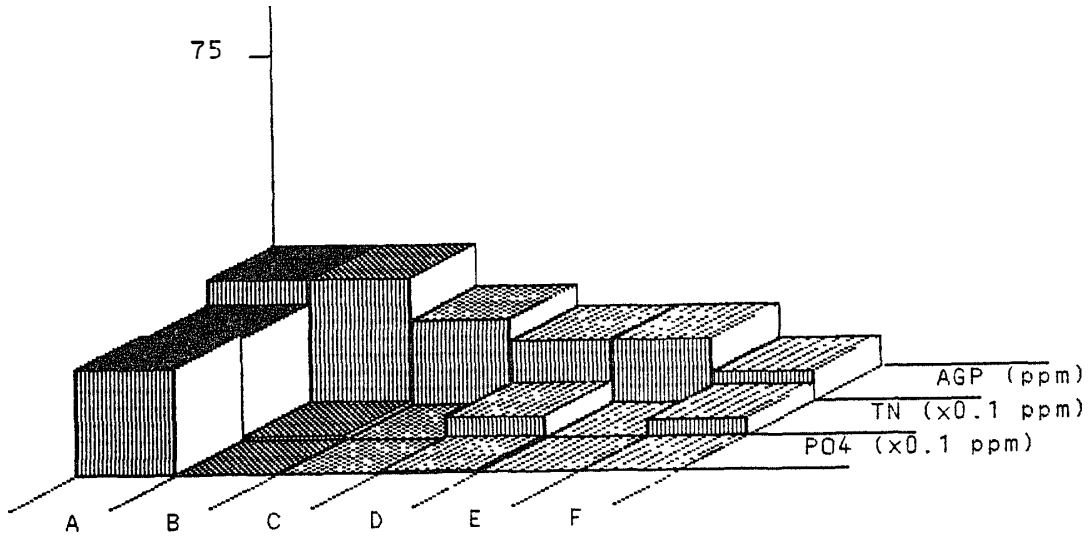

Fig. 1 Comparison of water quality and algal growth potential (AGP) of six small ponds in Enderby Land, East Antarctica. (Pond A is located near penguin rookery)

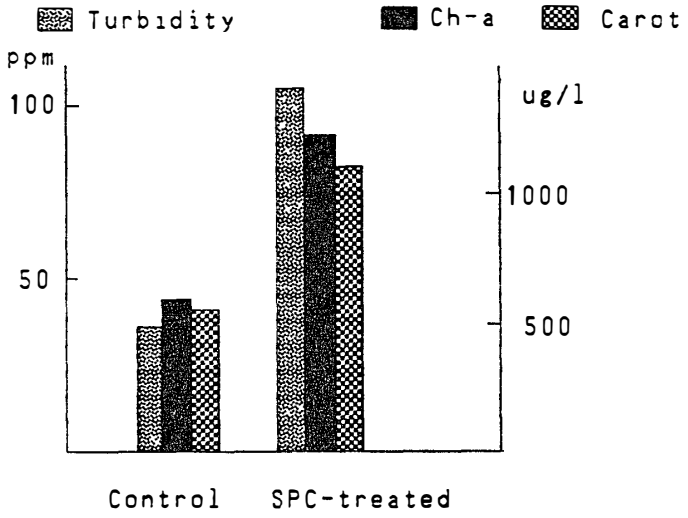

Fig 2. Growth response of Chlorella *sp. to the effect of elimination of allelochemics from pond A water by C18 column (SPC) treatment.*

effect of pond A water on the growth of *Chlorella* sp. But it could not be determined that the allelochemics in pond A originated from either the contaminants of penguin rookery or some active products of algal bloom (unidentified species) grown in the pond.

For an understanding of the algal ecology, particularly of their distribution and composition of community, it is necessary to investigate the environmental factors which determine the occurrence and survival of algae. It is also important to clarify the allelopathic interactions among the other coexistence biota.

References

AKIYAMA, M , KANDA, H. and OHYAMA, Y (1986a) Allelopathic effect of penguin excrements and guanos on the growth of Antarctic soil algae Mem Natl Inst Polar Res , Ser E., **37**, 11–16

AKIYAMA, M , OHYAMA, Y and KANDA, H (1986b) Soil nutrient condition related to the distribution of terrestrial algae near Syowa Station, Antarctica Mem Natl Inst , Spec Issue, **44**, 198–201

AKIYAMA, M , OHTANI, S and KANDA, H (1988) Allelopathic interactions as a possible determinant in the structure and composition of Antarctic plant communities Polarforschung, **58**, 279–284.

AKIYAMA, M , KANDA, H. and OHTANI, S (1989) Allelopathic effects of Antarctic lichens and mosses on the growth of algae Proc NIPR Symp Polar Biol , **2**, 220–222

RICE, E L (1984)· Allelopathy (2nd ed) Orland, Florida, Acad. Press, 189–205

(*Received May 1, 1991*)