

SUMMARY

The alga Phaeocystis sp. is a major component of several important marine ecosystems. It is also a striking appearance in the water since it forms colonies that are clearly visible with the naked eye. This thesis deals with the use and production of organic compounds by Phaeocystis.

Laboratory experiments were performed with a Phaeocystis strain isolated from the North Sea. The results of these experiments show that the alga is capable of using organic phosphates of low molecular weight as phosphorus source during growth in batch cultures. Growth rates on organic phosphates are the same as the growth rate on inorganic phosphate. Production of the enzyme alkaline phosphatase, capable of releasing phosphate from the organic moiety extracellularly, is derepressed at low inorganic phosphate concentration. The results indicate that Phaeocystis can efficiently use part of the dissolved organic phosphate pool present in the water in case the inorganic phosphate concentration drops to low levels during the spring bloom.

Measurements during the 1990 spring bloom in the Marsdiep showed that nitrogen was limiting Phaeocystis biomass development. The decline of the bloom was caused by lysis of algal cells. Grazing on Phaeocystis cells by copepods or sinking of Phaeocystis colonies were relatively unimportant loss factors. The organic matter produced by lysis of Phaeocystis cells fuelled the microbial foodchain (bacteria-heterotrophic nanoflagellates-ciliates). Copepods grazed on ciliates and thus ingested the Phaeocystis bloom in an indirect way.

Phaeocystis colonies consist of mucus in which the cells are embedded. The nature of the mucus polymers is still largely unknown. Laboratory experiments presented here show that the polymers contain carboxylated and sulfated saccharides. Together with calcium ions, these are important for the gelating of the mucus. Possibly mucus gel firmness and colony morphology can be adapted to environmental conditions.

During Phaeocystis blooms high concentrations of dimethylsulfide (DMS) have been found in the water. It was previously assumed that bacteria were responsible for the production of DMS from its precursor dimethylsulfoniopropionate (DMSP) that probably serves as an osmolyte in algal cells. It is shown here that Phaeocystis itself is capable of forming DMS from DMSP. The DMS production rate depends on the physiological condition of the cells, but may contribute significantly to total DMS production in the field.