

INTERACTION OF CADMIUM WITH ORGANIC MATTER EXCRETED BY DUNALLIELLA
TERTIOLECTA

Z. Kozarac, D. Krznarić and B. Čosović

Center for Marine Research Zagreb
"Rudjer Bošković" Institute, Zagreb
Yugoslavia

Summary

The physico-chemical interaction of cadmium with organic matter excreted by Dunallielia tertiolecta was studied by electrochemical methods in bulk solution and at model interface.

Résumé

L'interaction physico-chimique du cadmium avec la matière organique sécrétée par Dunallielia tertiolecta a été étudiée au moyen de méthodes électrochimiques en solutions et à l'interface modèle.

Study of dissolved and colloidal dispersed organic matter as well as its interaction with other micro- and macroconstituents in natural waters is of a substantial interest and importance for better understanding of the complex biogeochemical processes in aquatic environment.

The main source of organic matter in the sea is marine phytoplankton, whose healthy cells excrete various organic molecules during growth (WILSON, 1972, ŽUTIĆ et al., 1981). A large fraction of this organic matter is surface active and represents the main part of the surfactant activity in the sea.

Surface active substances play significant role in the regulation of the processes such as flocculation (HUNTER and LISS, 1979, GIBBS, 1983), bio-flocculation (AARONSON, 1973), association of organic matter with heavy metals (WALLACE, 1982) and scavenging of trace metals (BALISTRERI et al., 1981).

In this work we have studied, by using the electrochemical methods, the physico-chemical interactions of cadmium with the organic matter present in the phytoplankton culture media of the species Dunallielia tertiolecta, both in the bulk solution and at the model interface. It is known that insoluble unsaturated lipid material represents predominant excretion product of Dunallielia (ŽUTIĆ et al., 1981). Electrochemical investigations with oleic and linoleic acid particularly showed that these surface active substances have a strong effect on the mass and charge transfer processes of cadmium at the electrode surface (KRZNARIĆ et al., 1983). Main advantage of the applied electrochemical methods is the possibility of direct determination of trace amounts of different constituents of seawater, both trace metals and surface active substances, without pre-treatment of the sample and laborious analytical procedures, that could change the original composition of the investigated sample.

The investigations were done parallelly in the phytoplankton culture media with the presence and after the separation of cells by gentle centrifugation (3000 rpm). Electrochemical measurements were performed at two different pH values, natural pH of the media (pH~8) and in the acidic media (pH~2). It was found that the rate of the electrode reaction of cadmium decreases in the presence of the organic coating at the electrode surface. The degree of inhibition increases with increasing time of adsorption of surface active substances. The inhibition was also stronger in the acidic medium than at the natural pH of the phytoplankton media.

At the same time the complexing capacity of cadmium in the phytoplankton culture media was of the same order of magnitude as in natural seawater sample.

Our preliminary results indicate that in the case of cadmium in the phytoplankton media of the species Dunalliella tertiolecta there is a stronger interaction of metal with the organic coating at the electrode surface than with the organic matter in the bulk solution.

References

- AARONSON, S., (1973). Particle aggregation and phagotrophy by *Ochromonas*. Arch. Microbiol., 92: 39-44.
- BALISTRIERI, L., BREWER, P.G. and MURRAY, J.W., (1981). Scavenging residence time and surface chemistry. Deep-Sea Res., 28A: 101-121.
- ĆOSOVIĆ, B., (1984). Aqueous surface chemistry. Adsorption characteristic of organic solutes. Electrochemical evaluation. In: *Chemical Processes in Lakes* (Ed. Werner Stumm), J. Wiley, in press and cited references.
- GIBBS, R.J., (1983). Effect of natural organic coatings on the coagulation of particles. Envir. Sci. Technol., 17: 237-239.
- HUNTER, K.A. and LISS, P.S., (1979). The surface charge of suspended particles in estuarine and coastal waters. Nature, 282: 823-825.
- KRZNARIĆ, D., ĆOSOVIĆ, B. and KOZARAC, Z., (1983). The adsorption and interaction of long-chain fatty acids and heavy metals at the mercury electrode/sodium chloride solution interface. Mar. Chem., 14: 17-29.
- WALLACE, G.T., Jr., (1982). The association of copper, mercury and lead with surface active organic matter in coastal seawater. Mar. Chem., 11: 379-394.
- WILSON, W.B. and COLLIER, A., (1972). The production of surface active material by marine phytoplankton cultures. J. Mar. Res., 30: 15-26.
- ŽUTIĆ, V., ĆOSOVIĆ, B., MARČENKO, E., BIHARI, N. and KRŠINIĆ, F. (1981). Surfactant production by marine phytoplankton. Mar. Chem., 10: 505-520.