Interaction of Cadmium and Copper with surface active material released by marine phytoplankton

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Dissolved organic matter plays an important role in the physico-chemical forms and speciation of other micro- and macro-components in the aqueous phase. The presence of organic ligands regulates the bioavailability, bioaccumulation, toxicity and transport of trace metals through biological membranes (Anderson and Morel, 1982). Since phytoplankton exudates represent the main source of organic matter naturally occuring in seawater (Fogg, 1977) with a large fraction being surface active (Žutić et al., 1981), it is necessary to study its interaction with other ions and molecules of seawater constituents.

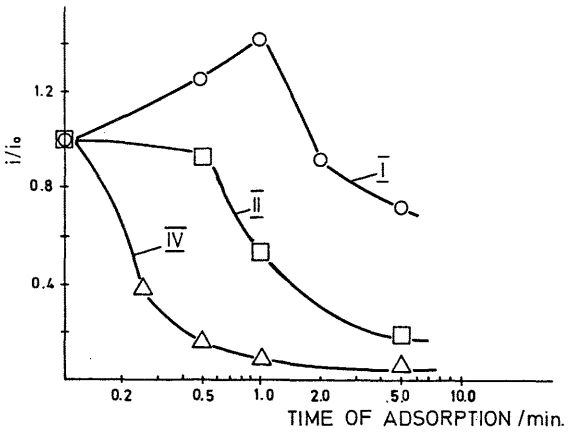
We report here on the investigation of the surfactant production by marine phytoplankton Dunaliella tertiolecta, as well as the study of physico-chemical interactions of cadmium and copper with released material, both at the model interface and in the bulk solution by using electrochemical methods (Ćosović and Vojvodić, 1982; Kozarac et al., 1982; Plavšić et al., 1982). Axenic cultures have been prepared by membrane filtration using previously cleaned Millipore filter, 0.22 /um (Kozarac et al., 1988).

Cultures were grown on modified f/2 media without and with trace metals and chelators. The results for surfactant activity, Cu complexing capacity and interaction with Cd at model interface are presented in Table 1 and Fig. 1.

Table 1: Surfactant activity and the apparent complexing capacity of different Dunaliella tertiolecta exudates. Cells were separated by gentle centrifugation (3000 rpm) prior to measurement. Cultures were grown on (I) modified f/2 medium without trace metals and chelators, (II and III) with trace metals and without chelators, and (IV) f/2 medium.

Dunaliella tertiolecta cultures	I	II	III	IV
Number of cells per ml	5.15×10^5	5.9×10^5	1.2×10^6	1×10^6
Surfactant activity equiv. T-X-100 (mg/l)	0.18	1.2	1.3	2.6
Surfactant activity equiv. T-X.100 per cell	3.01×10^{-10}	1.57×10^{-9}	1.3×10^{-9}	1.5×10^{-9}
Apparent complexing capacity mol Cu^{2+}/l	9.5×10^{-7}	5.8×10^{-7}	5.3×10^{-7}	-

Fig. 1. Relative decrease of reduction current of 10^{-5} M Cd^{2+} due to the presence of surface active material in different cultures of Dunaliella tertiolecta adsorbed at the mercury electrode/water interface.



It was shown that the content and type of released surface active material and complexing ligands depend on the initial composition of growth media. In all cases strong interactions of present organic substances with Cu in the bulk phase and Cd at the interface were observed. These will be discussed in terms of the comparison with results obtained with model substances as well as through investigation of real marine and estuarine samples.

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