
Dissertations

**The effect of selected
properties of humic
acids on cadmium
uptake in the mollusc
*Mytilus trossulus***

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Ph. D. thesis in biological oceanography supervised by Associate Professor Janusz Pempkowiak.

The thesis explores the influence of humic acids on cadmium (Cd) uptake in *Mytilus trossulus* from the Gulf of Gdańsk. Humic acids are organic substances capable of forming complexes with Cd and can raise or restrict Cd uptake in marine benthos organisms.

Earlier research into Cd accumulation in *M. trossulus* in the Baltic showed that humic acids enhance Cd uptake in Baltic invertebrates. One objective of this Ph. D. thesis was to determine the influence of the size of humic acid molecules on the rate of Cd uptake in *M. trossulus*. Another was to attempt to discover the significance of humic substances in Cd accumulation under natural conditions.

After the introduction and a statement of objectives, there follows a theoretical section, covering the systematics and morphology of the species, as well as its physiology, distribution and role in the ecosystem. The author then goes on to discuss the effect of biotic and abiotic factors on Cd accumulation in marine organisms. The experimental part contains a description of the apparatus, the material and the methods employed. The results are presented together with the discussion.

The considerable cognitive importance of this work must be emphasised. This research has demonstrated that the Cd content in the soft tissue of this mollusc is dependent on both the exposure time and the metal concentration. The longer the period of exposure to Cd and the higher the Cd concentration in water, the faster the metal is accumulated.

The first stage of the research covered Cd uptake in the various internal organs of the mollusc and the rate of Cd transport to the analysed parts of the mollusc with respect to exposure time. The most significant changes in the distribution of the accumulated Cd occur during the first 24 h of exposure. During the first hour of the experiment the Cd concentration was highest in the gills, somewhat less in the liver-spleen and least in the remaining soft tissue. It was found that Cd uptake in *M. trossulus* is mainly active; by contrast, Cd enters the shell mainly through sorption, *i.e.* by passive uptake. The presence of humic acids in the water causes these and the Cd ions bound to them to coabsorb on the exterior surface of the shell. Moreover, the presence of humic acids in water modifies the process of Cd uptake: in water free of humic acids, Cd uptake is lower compared to the levels recorded in molluscs exposed to an environment containing humic acids. This relationship is, however, not directly proportional.

An original finding was the fact that humic acids from different environments affected the intensity of Cd uptake to a varying extent: this could have been due to the different physical and chemical properties of these acids.

The molecular mass of the acids is the factor determining the nature of their influence on Cd uptake in this mollusc. Regardless of the origin of these humic acids, the rate of Cd uptake increases as their molecular mass decreases.

The final part of the results/discussion section deals with environmental studies, the effect of humic acid concentration in Baltic bottom sediments on Cd concentration in this mussel. The presence of humic acids in natural sediments leads to an increase in the Cd content in the mollusc's body.

Joanna Kożuch's Ph. D. thesis has contributed much interesting information on the effect of humic acids on Cd uptake by marine invertebrates.

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