Doklady Biological Sciences, Vol. 383, 2002, pp. 127–130. Translated from Doklady Akademii Nauk, Vol. 383, No. 1, 2002, pp. 138–141.

GENERAL BIOLOGY

A New Type of Effect of Potentially Hazardous Substances: Uncouplers of Pelagial–Benthal Coupling

S. A. Ostroumov

Presented by Academician V.L. Kas'yanov November 7, 2001

Received November 8, 2001

Hydrobionts are mediators of "biogenic migration of atoms in the biosphere" [1]. This migration is partly implemented in the framework of pelagial–benthal coupling. Trophic activity of bottom filter feeders results in consumption of the organic matter of plankton synthesized in pelagic zones (see, e.g., [2]). Even the organic matter that is not assimilated by fulter feeders is involved in pelagial–benthal coupling. Suspended matter of aquatic ecosystems (including pellets of invertebrates) is subjected to gravitational sedimentation [2, 3]. The pellets of invertebrates are formed as a result of excretion of unassimilated and undigested food of phytophagous invertebrates. The degree of food assimilation in different taxa of invertebrates ranges from 1 to 98% [4, 5]. The mean percentage of food assimilability averaged over many groups of organisms is 16.2–89.6% (Table 1). Therefore, the rest of the food matter (10.4–83.8%) remains unassimilated and settles to the bottom with pellets. Thus, pellets of invertebrates are able to transport a fraction of organic matter synthesized in the pelagic zone by photosynthetic organisms from this zone to the bottom layers of aquatic ecosystems, i.e., to the habitat of benthic organisms (the benthal).

The goal of this work was to determine whether there is a potential hazard of disturbance of the pelagial–benthal coupling induced by water pollution. It should be noted that such a hazard of the pollution-induced disturbance of ecosystems has been almost entirely ignored thus far.

Bivalve mollusks were objects of this study. Because bivalve mollusks are involved in elimination and sedimentation of particles suspended in bulk water, these organisms are components of the pelagial–benthal coupling [6–11].

The effect of potassium bichromate, a xenobiotic, on the rate of elimination of suspended particles by the Black Sea mussel *Mytilus galloprovincialis* was studied. Experimental methods were described elsewhere [10, 11]. Mussels (kindly provided by of A.V. Pirkova and A.Ya. Stolbov) were grown in water headers in the outskirts of the city of Sevastopol. The mean body weights (raw weights with shell) of experimental (treated with potassium bichromate) and control mollusks were 6.53 and 6.59 g, respectively. Both control and experimental tanks contained 13 specimens of mussel each. Each tank contained 500 ml of sea water (18ppt). The initial concentration of the yeast *Saccharomyces cerevisiae* (SAF-Moment, S.I. Lesaffre, 59703 Marcq-France) suspension in tanks was 40 mg dry weight per liter. The water temperature was 23.4°C. The optical density was measured spectrophotometrrically using a SF-26 LOMO spectrophotometer and cuvettes with an optical path length of 10 mm. Similar experiments were performed with the oyster *Crassostrea gigas*, which was also grown under mariculture conditions.

The results of our experiments showed that potassium bichromate is capable of inhibiting the filtration activity of mollusks (Table 2). This reduces the amount of food available for the digestive system of the mollusks. The decrease in the amount of food removed from water (i.e., the ration decrease) was accompanied by a visually observed decrease in the rate of formation of pellets. The amount of pellets in the end of the experiment in tanks containing potassium bichromate solution in water (0.05 mg/l) was significantly less than in control tanks. It was found in our experiments that oysters (*C. gigas*) were significantly less sensitive to potassium bichromate than mussels (*M. galloprovincialis*).

A similar decrease in the amount of suspended particles (plankton cells) eliminated from water was observed in our experiments with other xenobiotics, including surfactants, synthetic washing mixtures (SWMs), and liquid washing mixtures (LWMs) (Table 3). In all cases studied, we found that inhibitors of filtration activity caused a decrease in the rate of formation of pellets. Only a few examples of such effects are shown in Table 3. Inhibition of filtration processes was also reported by J. Widdows, P. Donkin, D. Page, A.V. Mitin, and some other researchers [9, 10].

In addition to experimental studies on plankton elimination from water by marine and freshwater

Moscow State University, Vorob'evy gory, Moscow, 119899 Russia

0012-4966/02/0304-0127$27.00