

A.V. SEYTKALIEVA, N.I. MENZOROVA

Enzymatic bioassays used for pollution monitoring of marine environment

Key words: seawater pollution, of phosphatase test, Strongylocentrotus intermedius

The increasing environmental pollution and growing anthropogenic pressure on aquatic ecosystems make actual searching and developing easy-to-use and highly sensitive methods to test seawater quality. The highly sensitivity methods of physicochemical monitoring do not provide complete information on the content of complex pollutants in seawater. The other global approach for pollution monitoring is using because only the responses of living systems are able to integrate the various complex effects of contaminations. To assess environmental conditions in marine coastal waters the bioassays is widely applied using sea urchin gametes and embryos. The bioassay is sensitive to the presence of heavy metals, pesticides and detergents in seawater. “Sea Urchin Sperm Cell Toxicity Test” (SUSC test) has been developed and accepted as an official document for rapid evaluation of the toxic substances in wastewater and seawater [1].

We have developed a number of methods by using the sea urchin reproductive products to assess the effects of various contaminants in the aquatic environment. Our fluorescein diacetate (FDA) method is proposed to assay the nonspecific esterase activity of sea urchin sperm. The degree of fluorescence depends on the physical and metabolic states of the cell. It has been proved that the esterase activity can be reliable indicator of the toxic effects of pollutants.

Presently two our enzymes are unique due to retain their activities in high salt solutions, included seawater, they isolated from the sea urchin *Strongylocentrotus intermedius* eggs. They are salt resistant alkaline DNase and phosphatase. Based on the enzymes we have developed highly sensitive express test systems to evaluate the level of seawater pollution in model experiments [2, 3].

All these bioassays, the SUSC-test, FDA method, DNase and phosphatase tests, were used for pollution monitoring of some water areas of the Japan (the Tumen River mouth; Troitsa bay, Peter the Great Bay; Ussuri and Amur Bays) and Okhotsk (east shelf of Sakhalin, near oil rigs and methane anomalies; the Sakhalin Gulf; and near the Kunashir island after the explosion at the nuclear power plant Fukushima) Seas both in natural surroundings and under anthropogenic impact.

Comparing the results of four test-systems has shown that the sensitivity of phosphatase test to general pollutions relatively similar to that of SUSC-test. The FDA method was the least sensitive to the presence of pollutants. The phosphatase test appeared to be more sensitive to the presence of heavy metals and oil products in seawater than the DNase test. However, the DNase was inhibited by a wider range of chemical compounds than phosphatase.

* SEYTKALIEVA Alexandra Valerevna – PhD, Researcher, MENZOROVA Natalia Ilinichna — PhD, Senior Researcher (G.B. Elyakov Pacific Institute of Bioorganic Chemistry, FEB RAS, Vladivostok, Russia). E-mail: sasha0788@inbox.ru

REFERENCES:

1. Dinnel P.A. et al. Improved methodology for a sea-urchin sperm cell bioassay for marine waters // Arch Environ Contam Toxicol. 1987. Vol. 16, P. 23–32.
2. Menzorova N.I., et al. Enzymatic methods for the determination of pollution in seawater using salt resistant alkaline phosphatase from eggs of the sea urchin *Strongylocentrotus intermedius* // Mar Poll Bull. 2014. Vol. 79. P. 188-195.
3. Menzorova N.I., Rasskazov V.A. Application of the sea urchin *Strongylocentrotus intermedius* embryo DNase test in the evaluation of marine water pollution by various toxicants // Rus J Mar Biol. 1999. Vol. 25, N 1. P. 60 – 64.