

BIOMONITORING OF TOXIC METALS IN MARINE ORGANISMS IN THE COAST OF SÃO PAULO BY NEUTRON ACTIVATION ANALYSIS AND ATOMIC ABSORPTION

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Coastal regions in many parts of the world have been for a long time suffering severe impact from industrial and agricultural activities, causing serious concern to health and environmental authorities as to the effects to the fauna and to the populations of these regions. These concerns call to the need for effective monitoring programmes, aimed at assessing the quality of the waters and to the degree of pollution encountered, by means of analysis of marine organisms and sediments, as well as analysis of the water itself. In order to better understand and prevent whenever possible the occurrence of such regrettable events, in 1976, in the US, the "Mussel Watch Programme" was started, aiming at utilizing the so-called "sentinel organisms" like mussels (*Mytilus*) and oysters (*Ostrea* or *Cassostrea*) for the biomonitoring of coastal areas. Several other countries have also started programmes of this kind. The main inorganic elements of interest to this kind of programme are the ones considered as most potentially toxic, such as: mercury, lead, cadmium, arsenic, nickel, copper, zinc, antimony and others. Besides the inorganic components, also the determination of organic components is very important, such as PCBs and PAHs. In several studies, besides the analysis of toxic elements in the marine organisms, the mechanisms of incorporation of these elements and the influence of several physico-chemical parameters are studied, using radioactive isotopes. Chong and Wang studied the assimilation of cadmium, chromium and zinc by the bivalves *Perna viridis* and *Ruditapes philippinarum*, which are commonly used as biomonitors of coastal contamination in tropical and subtropical waters.

The authors determined the efficiency of assimilation of the three cited elements, in the marine organisms by feeding them with different species of phytoplankton. The study demonstrated that the organisms are capable of accumulating metals from the food ingested and that the type of food seems to have different effects in the assimilation of metals from the different kinds of bivalves. Bechmann et al determined the concentrations of the elements vanadium, chromium, cobalt, nickel, copper, gallium, rubidium, cadmium, barium and lead, in the soft tissue of the blue mussel, *Mytilus edulis*, in seven different sites of the Limfjorden, in Denmark. The mussels in the different sites could be distinguished by means of principal component analysis. The comparison of the levels of trace elements found in the mussels, with relation to the levels of 1982, has shown that the contamination with trace elements in the regions studied has increased in the last 15 years. By the data obtained, it was concluded that the blue mussel is a good indicator for the identification of coastal areas exposed to metallic contaminants.

In Brazil, due to the extension of the coast and to the numerous pollution problems encountered in several regions, it is necessary to obtain a great volume of data with relation to the monitoring of many environmental compartments, such as water, soils, sedime. The aim of this project is to give a contribution to the biomonitoring of some regions of the coast of the State of São Paulo, by using the bivalve *Perna perna*, which is commonly found in the whole Brazilian coast and is consumed by the population, in an amount estimated in seven tons per month, in São Paulo. Due to its sedentary habits and its ability to concentrate many pollutants, the *Perna perna* is been used in studies of evaluation of the quality of coastal waters.

The project will be conducted in collaboration with the Oceanographic Institute of the University of São Paulo. For the utilization in the experiments, healthy animals have to be obtained, collected in regions far away from sources of pollution. The organisms to be utilized in this project will be acquired in a cultivation site situated in the Castelhanos Beach, in Ilha Bela, an isolated beach which is difficult to be accessed by tourists. The organisms will be transplanted to several points along the coast, from São Sebastião to Santos. The sites chosen in Santos are strategic in the sense that they monitor the Bay of Santos, with relation to industrial emissions and to the emissary of SABESP. Every three months, the organisms will be removed from the transplant points and their enzymatic activity will be measured, in the Oceanographic Institute. The analysis of trace elements will be carried out at the Neutron Activation Analysis Laboratory, at IPEN/CNEN-SP, using two analytical techniques: neutron activation analysis (NAA) and atomic absorption spectroscopy. By using a suitable combination of irradiation and measuring times, it is possible to determine by NAA elements such as: Cl, Cu, I, Mg, Mn, Ti, V, As, Ba, Br, Ca, Cd, Co, Fe, Hg, Mo, Na, Sb, Sc, Se, REE elements.

By atomic absorption spectroscopy the aim is to determine mainly: Hg (CVAAS), lead, which is not possible to determine by NAA, cadmium and selenium.

The speciation of mercury, namely determination of methylmercury, in the marine organisms, will be carried out by CVAAS, using a method of separation of organic and inorganic species of mercury based on ion exchange, followed by destruction of methylmercury by UV radiation or acid decomposition.