Elemental Ratios in Marine Mussels for Assessment of Ecological Characteristics

Pavel Nekhoroshkov

Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research, Russian Federation
p.nekhoroshkov@gmail.com

The elements in mussel tissues and shells determined by using instrumental neutron activation analysis could provide additional information about accumulation process in the selected aquatic areas. The specific ratios indicate the features of environmental conditions affecting such filtrate organisms. These findings could be used for characterization of the local water areas, biomonitoring studies or ecological state assessment.

The data were obtained during wide period of observation (2013–2020) in different water areas of the South Africa and the Black Sea. According to ratios of elements in shells and soft tissues. It was found that the mussels adapted to the typical coastal conditions by using depositional mechanism could regulate the inner relation of essential and other trace elements.

In general, the length of mussel shells was correlated with the content of Co and Ni in shells with relation to Ca. It is important to note that Mg/Ca demonstrated inverse correlation with length of shells. This indicated the specific physiological mechanism that reduces Mg/Ca during the calcification process, which are probably associated with temperature regime. The higher levels of the Mn/Ca ratios in shells found in the polluted bays are probably associated with entering biogenic elements. The higher Na/Ca ratios indicated the lower salinity bays, with influence of river currents in marine areas. The reverse pattern was found for Mg/Ca corresponded to temperature features of local water areas.

Fe/Al in soft tissue indicated additional source of iron in depends on biological proxy (phytoplankton). The mussels from the polluted eastern bays demonstrated relatively stable Fe/Al levels influenced by the river runoff (indicated by the high levels of Al), while in the mussels from the western polluted stations the higher levels of Fe/Al could be explained by specificity of the water discharges, containing high levels of Fe. The higher As/Sc ratio demonstrated the increasing of proportion of anthropogenic arsenic in relation to the non-volatile Sc in the areas of coastal discharges. However, the levels of terrigenous component, which could be indicated by the Al, Sc, Th et al., should be considered.

The mussels from the Black Sea water areas despite the typical lower salinity levels demonstrated the same patterns of studied ratios in soft tissues and shells. The higher ratios of Mn/Ca such as in polluted South African bays indicated the seasonal increasing of the biogenic elements and phytoplanktonic assemblages.