

MUSSELS (*MYTILUS GALLOPROVINCIALIS*) AS BIOINDICATORS OF SEAWATER CONTAMINATION

S. Jovetic¹, M. Vojinovic-Miloradov¹, J. Adamov¹, D. Buzarov¹, P. Jurlina²

¹University of Novi Sad, Faculty of Sciences, Department of Chemistry, Trg Dositeja Obradovica 3, Novi Sad 2100, Serbia and Montenegro, Tel. +38121350696,

E-mail: jovetics@ptt.yu

²Institute of Marine Biology, Dobrota b.b., Kotor 85330, Serbia and Montenegro,

E-mail: jurlina@cq.yu

Abstract

Polychlorinated biphenyls (PCBs) are one of the major pollutants of water basins. Therefore during scientific research special care should be taken of the biology and ecology of the fish and other sea organisms. They are an important part of the human food chain and also important for the production of healthy food and organized mariculture. In addition during research, sediments and the seawater, in which the organisms grow, live and feed, should be analysed. Increasing urbanization, which occurred in Boka Kotorska bay led to a flush of a big amount of liquid wastes. As a consequence the ecological balance of the bay is destroyed. An increased concentration of PCB was found in the vicinity of shipyards, airports, ports and factories. The used research samples were mussel- *Mytilus galloprovincialis*, which feeds by filtering seawater. The achieved results show that the presence of PCB in sediment and seawater causes the accumulations of PCB in body of mussels. All that can lead to a whole range of consequences, which affect the organisms in question as well as people who use them for food. The aim of this study was to determine the levels of PCBs in mussels from the Boka Kotorska bay waters.

Introduction

Boka Kotarska bay (Fig. 1) has a specific location in the Adriatic Sea. Its specific character is in relation with a geographic position and with abiotic and biotic factors of living as well. Because of that Boka Kotorska bay is a very specific biotope. In comparison with open Montenegro sea, Boka Kotorska bay has autonomic climatic, hydrological and hydrographical elements.

Fast urbanization and industrialization make the base problems in Boka Kotorska bay. Wastes from plants disturb ecological balance of water world. (1)



Figure 1. *Boka Kotorska bay*

Boka Kotorska bay is of special interest for an evaluation of the entry, extent and fate of pollution by chlorinated hydrocarbons such as PCBs and chlorinated pesticides. Polychlorinated biphenyls are mixture of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. However, if they build up in the environment they can cause harmful health effects.

PCBs and chlorinated compounds enter the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.

PCBs and OCl can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.

PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distance in the air and be deposited in areas far away from where released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments.

PCBs and organochlorine compounds are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs are accumulating in fish and marine mammals, reaching levels that may be many thousands of times higher than in water. (2)

Shells such as oysters and mussels are sensitive indicators of long-term average water contamination because they filter large quantities of water as they feed and tend to accumulate the contaminants in their tissues. (3)

Mussels, as very popular and widespread indicator organisms, were analyzed most frequently in comparison with other species.

Mytilus galloprovincialis (Fig.2) is a type of the mussels which naturally colonize Boka Kotorska bay. This edible species has been farmed as well. Also, it is very suitable as bioindicator of the pollution and variously used as test-organism in recent time. (4)



Figure 2. *Mussels Mytilus galloprovincialis*

Methods

Mussels were collected from three sampling stations located in Boka Kotorska bay:

1. Airport (Tivat)
2. Donja Lastva
3. Solila

Mussels were collected manually in May 2001.

Extraction was performed from homogenized mussels tissues with water/methanol/chloroform=1/2/2 mixture. After filtration and evaporation, extract was dissolved in hexane and purified with conc. sulphuric acid.

Standard TCL Pesticides Mix, SUPELCO was used for qualitative and quantitative determination of organochlorine compounds.

Polychlorinated biphenyls were determined on the base of fore and more characteristic peak from the standard Ar-1254, SUPELCO.

Conditions for gas-chromatographic determination

Qualitative and quantitative determination of organochlorine compounds was performed on GS:

Apparatus: Hewlett Packard 5890 SERIES II

Capillary column: DB-1701P 25m, 0.32mm, 0.25 μ m.

Injector: Temp. 250 °C. Split injection. Split ratio 1:15.

Transport gas: extra N₂, 1.5 ml/min.

Temperature: 215°C, isothermal 15 minutes.

Detector: ECD (Electron Capture Detector), Temp. 300°C.

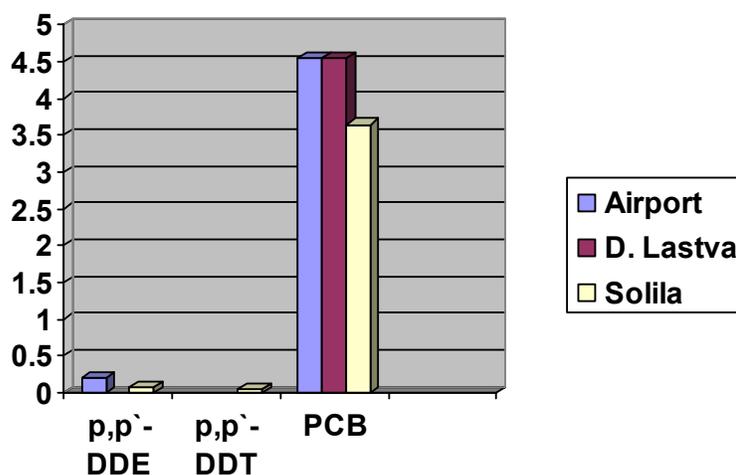
Results

Results of experiment are given in Table 1. and Graph 1. There are shown just detected organochlorine compounds and total PCBs.

Table 1. Concentration of organochlorine compounds

Location	<i>p,p'</i> -DDE (ng/g)	<i>p,p'</i> -DDT (ng/g)	PCB (ng/g)
Airport (Tivat)	0.20	0.35	4.55
Donja Lastva	ND	ND	4.55
Solila	0.07	0.05	3.64

ND – not detected



Graph 1. Content of OCI in selected samples

Discussion

The achieved results show that the presence of PCB in sediment and seawater causes the accumulation of PCB in body of Mussel. Organochlorine compounds are present in much lesser degree than PCBs.

Increased concentration of PCB was found in the vicinity of the airport, which is in accordance with the urbanization of this locality as well as higher population density and busy traffic activities.

Conclusions

On the basis of the given results it can be concluded that contamination of selected locations is not significant for organochlorine compounds but it is not minor for PCBs concentration. All that can lead to a whole range of consequences, which affect the organisms in question as well as people who use them for food.

Acknowledgments

This work was supported by the Serbian Ministry of Science, Technology and Development, Project No. 1622.

References

1. O. Doklesic: Akcidentne situacije morskog (obalnog) pojasa od Ulcinja do Igala. *Zastita vode*, 32-37, (1996).
2. ATSDR. ToxFAQs Polychlorinated Biphenyls (PCBs).htm
3. Coast & Oceans Chemical Contaminants.htm
4. P.Ostapczuk, J.D. Schladot, H. Emons, K. Oxynos, K.W. Schramm, G. Grimmer and J.Jakob: Environmental monitoring and banking of marine pollutants by using common mussels, *Chemosphere*, **34**, 2143-2151, (1997).