TOXICITY-CHEMISTRY RELATIONSHIPS IN SEDIMENTS COLLECTED FROM BLACK SEA

R. Oral 1, B. Buyukisik 1, F. Kucuksezgin 2, E. Y. Ozkan 1 and E. Darilmaz 2

1 Ege University, Faculty of Fisheries - rahime.oral@ege.edu.tr
2 Dokuz Eylul University, Institute of Marine Sciences and Technology, 35340 Izmir, Turkey

Abstract
This research investigated the spatial distribution of chemical contamination and toxicity of marine surficial sediments collected from six sites along the Turkish coast in Black Sea. Sediment toxicity to sea urchin (Paracentrotus lividus) embryonic development was evaluated with whole sediment specimens. Concurrently, sediment samples were analyzed for their chemical characterisation to evaluate toxicity data.

Keywords: Ecotoxicology, Sediments, Black Sea, Petroleum, Metals

Introduction
It is difficult task to make a decision about toxicity of sedimentary contaminants to aquatic organisms. Bioassays are routinely used for sediment quality evaluation. Among these sea urchin embryotoxicity bioassays are recognized as reliable, sensitive and ecologically important tools for evaluating marine and estuarine environmental quality [1-2]. The goals of this study were to determine concentration of metals and petroleum hydrocarbons in Black Sea sediments and relationships between contamination and biological effects.

Material and Methods
Sediment samples collected from six sites along the Turkish coast in Black Sea (Istanbul, Eregli, Sinop, Ordu, Trabzon) by using core sampler. Surface sediment samples were taken from upper 2cm. depth for chemical and toxicological analyses. Determination of petroleum hydrocarbons were made by GC-FID according to UNEP [3]. 0.2g dry sediment samples were digested with HCl,HNO3,H2O2-HF acid mixture. Differential Pulse Anodic Stripping Voltammetry (DP-ASV) was used for Cu, Pb and Zn by using Metrohm Voltammetry model 797VA. Computerization according to Metrohm VAApplication Work AWUK4-0134-042002. C14 dating was made in Beta Analytic Inc. The embryotoxicity test with sea urchin (Paracentrotus lividus) embryos was performed using the procedure reported in detail in before [1]. Bioassays were carried out in by evaluating the following endpoints: a) normal (N) pluteus larvae; b) retarded (R) pluteus, with size <1/2 N, yet no evident abnormalities; c) malformed plutei (P1) exhibiting a number of skeletal or other abnormalities; d) developmentally arrested embryos (P2), i.e. unable to undergo larval differentiation (blastulae or gastrulae), and e) dead (D) plutei (D1) or early embryonic death (D2).

Results and Discussion
Bioassay with sea urchin showed that the highest embryotoxicity was exerted by the sediment from Istanbul (P1+P2 = 100 %) compared to controls (P1+P2 @ 3.5%). Sediments from Zonguldak and Inebolu displayed significantly higher developmental toxicity while the other sediment samples failed to show any significant difference compared to blank controls (Table1).

Tab. 1. Developmental toxicity of sediment samples collected from Turkish coast in Black Sea. % Developmental defects in P. lividus larvae, means ± SEM.

The concentrations of petroleum hydrocarbons, metal and % organic carbon of sediment samples are given in Table2. Readman el. al. [4] was reported 6.4 ng/g naphthalene concentration in Bosphorus (Istanbul) sediment samples. This result consistent with present data measured in Istanbul (7.0 ng/g). ΣPAH levels of all stations were much smaller than ERL value of 4122 ng/g. It has not been expected toxicity from ΣPAH value. The aliphatic hydrocarbon, n-C17 concentrations was significantly related to % developmental defects of sea urchin (R²=0.84). Bioaccumulation dynamics of aliphatic hydrocarbons in detritusores fishes and codding feed crude oil controlled by an efficient molecular discrimination during intestinal absorption. Higher bioaccumulation factors has been found in the range of between n-C15 and n-C17 [5]. It was suggested that the correlations were probably related to hydrophobicity and bioaccumulation factors of n-alkanes like fishes. Trace metal concentrations was not correlated with toxicity data. The only station Zonguldak was not exceeded the ERL values according to metals. Suddenly drops of Cu and Pb in Zonguldak was due to the fact that surface sediment layer dated to 1780±40BP (calculated AD 130-350 )

Tab. 2. Petroleum hydrocarbons and some metals concentrations in six sediment samples from Black Sea and ERL guideline values (Effects-Range-Low). All HC values are as ng/g.

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References