Heavy metals in seawater and surface sediments of the Gulf of Bourgas

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The Gulf of Bourgas is one of the highly polluted regions of the Black sea coasts. The pollutants includes petroleum products as well as heavy metals. The pollution is due to the geomorphological characteristics of the gulf as well as the presence of a large number of chemical industries in the vicinity of the sea. The investigations on the heavy metal present in the sea-water and the surface sediment is rather scarce. Therefore such a study is very interesting from the analytical as well as ecological viewpoint.

In May and September 1991, an average sample was done simultaneously from the sea water and the surface sediment at three different stations : namely Bourgas Port (I), Petroleum Port (II) and the bulk of the gulf (III). The samples were analysed by suitable electroanalytical methods.

The sediments were collected from the surface by a conventional apparatus, dried at a temperature of 105°C, grinded and fractioned. The preweighed dry sample (d < 0.06 mm) was dissolved in HCl (2:1) on heating, filtered out and analysed by polarographic method with standard deviation [1]. The completeness of the extraction process was controlled by the atomic emission spectral analysis of the insoluble residue.

The Pb content was determined directly in the filtrate. A part of the solution was evaporated to complete drying, then dissolved in excess NH_3 and filtered again. Cu, Zn and Cd contents were determined simultaneously by the polarographic method.

The samples from the sea water was collected in plastic bottles pretreated with HNO_3 and filtered through a membrane filter (pore-diameter < 0.45 μ). With a view to eliminate the organic impurities, the samples were subjected to electrochemical anodic oxidation at +1.4 V for 10 min in a graphite container.

The mentioned heavy metals in the sea-water were determined by a method of anodic stripping voltametry (ASV) [2] under the following conditions: stripping process on HMDE at 1.2V vs SCE for 10 min, deoxidation with N_2 and anodic dissolution of the deposited impurities at a rate of 400 mV/min. The metals under investigation show well-defined sigle peaks and their concentrations were determined by a method of standard addition.

Table 1

Heavy metals in sea-water (sw), μg/l and sediments (sed) μg/g dw

Station		Cu		Zn		Cd		Pb	
		V	IX	V	IX	V	IX	V	IX
I	sw	10.3	11.2	9.3	9.9	0.25	0.23	0.05	0.05
	sed	93.4	99.9	52.4	53.3	3.70	3.90	73.40	78.80
II	sw	15.1	16.8	10.4	10.5	0.28	0.30	0.06	0.07
	sed	115.2	107.6	53.3	61.4	4.80	4.70	79.50	78.10
III	sw	8.7	9.1	10.1	12.0	0.21	0.23	0.04	0.07
	sed	82.2	82.1	50.8	52.2	3.60	3.70	70.40	73.30

The experimental results show that the concentrations of Cu and Cd at station II are the highest - a fact most probably attributed to the presence of Copper mine nearby. The Pb concentrations is comparatively higher at the stations I & II, however Zn concentration is almost constant. Although no general conclutions can be drawn for the seasonal changes in the heavy metal contents, it may be noted that in September, their concentrations are higher. There exist some correlation between the heavy metal contents in the sediments and that in the corresponding sea-water.

The electrochemical methods proposed for the analysis of Cu, Cd, Pb & Zn are rapid, sensitive and selective. Relative standard deviation for the polarographic determination is 2-5 % and that for ASV is 8-12 % (n =6).

REFERENCES

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