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 include petroleum products as well as heavy metals. The pollution is due to the geomorphological charateristics 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 metals present in the sea-water and the surface sediment are rather scarce. Therefore such a study is useful.

In May and September, 1991, samples were done 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 for the concentrations of Cd, Cu, Pb and Zn by a suitable electroanalytical method.

The sediments were collected from the surface by mechanical drilling, dried at a temperature of 105° C, grinded and fractioned. A preweighed dry sample (d < 0.06 mm) was dissolved in HCl (purified by isothermal distillation) on heating in a closed container at 250°C for 10 h, filtered out and analysed by a polarographic method with standard addition (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, Cd and Zn contents in a samplewere determined simultaneously The half-wave potentials of the elements under these conditions were respectively -0.3V, -0.8V and -1.4V vs SCE.

The samples from the sea water were collected in plastic bottles pretreated with HNO_3 and filtered through a membrane filter (pore-diameter < 0.45 μ). In order to eliminate 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), mg/l and sediments (sed) mg/g dw

Station	elements	Cu		Zn		Cd		Pb	
	month	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 mentioned concentrations are the averages of 6 parallel measurements.

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 and II, however Zn concentration is almost constant . Although no general conclusions can be drawn for the seasonal changes in the heavy metal contents, it may be noted that in September (IX), their concentrations are higher than in May (V). There exists some correlation between the heavy metal contents in the sediments and that in the corresponding sea-water. Due to the limited number of investigations, the obtained data for the concentrations show the relative pollution in the investigated regions of the gulf .

The electrochemical methods proposed for the analysis of Cu, Cd, Pb and 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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