

LEVELS OF SEVEN PCB CONGENERS IN THE GULF OF ELEFSIS

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Despite the fact that PCB's have been identified since the sixties as some of the most acute pollutants of the Mediterranean Environment, it is surprising how little concrete information is available, even today, about their actual levels in some parts of the Mediterranean Sea.

Information about their speciation between dissolved and particulate phases and at various depths of the water column, as well as between the water and sediments of the site, are also rare. In the present work we present the results of a survey carried out in the Gulf of Elefsis, a semi-enclosed embayment near Athens which receives the effluents of a number of industries and is affected also by the Athens sewage outfalls which are located near its eastern entrance (Fig. 1.) The substances studied were the following PCB congeners: PCB-18, -28, -52, -101, -153, -138, and -180. The focus of the present paper is the discussion of the levels of their concentrations in water, suspended solids and sediments taken from five sites shown in the map. Solid-phase extraction (C₁₈) procedure applied prior to the separation. Single PCBs were determined by HRGC-ECD on two capillary columns of different polarity, with internal standard. In the Tables 1 and 2, the mean - minimum - maximum concentrations of the PCB congeners are given from the water samples (suspended solids and dissolved water phase) during the winter and summer of 1992. The mean concentrations of the PCB congeners in sediments and their minimum - maximum values are presented in Table 3. The sediment samples have a total organic carbon content from 4.65 to 1.36 % (dry weight). The concentrations show the real tendency of the PCBs and to a lesser extent of other organochlorine compounds to accumulate more in suspended solids and sediments than in the dissolved water phase following their hydrophobic nature. Some discrepancies from the general rule could account on the existence of colloidal determined with the dissolved phase of the water samples (BAKER *et al.*, 1986; ALBAIGES *et al.*, 1991; KAMLET *et al.*, 1998).

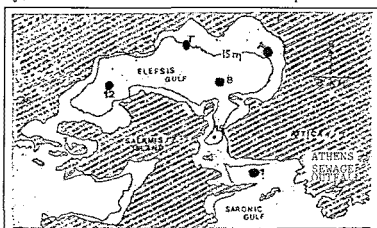


Fig. 1. Map of the Elefsis Gulf and the sampling grid

Table 1. Mean - Minimum - Maximum Concentrations (ng/lit) of the PCBs congeners in Suspended Solids during the winter and summer of 1992 in the Gulf of Elefsis

	Concentrations - Winter			Concentrations - Summer		
	Mean	Mini.	Maximum	Mean	Mini.	Maximum
1. PCB-18	0.644	M.A	0.92	0.546	0.28	0.86
2. PCB-28	1.394	0.93	2.56	2.016	0.92	2.8
3. PCB-52	M.A			M.A		
4. PCB-101	1.372	0.95	2.91	1.68	0.96	2.65
5. PCB-153	0.518	0.211	1.00	0.582	0.23	1.26
6. PCB-138	0.155	M.A	0.39	0.045	M.A	0.15
7. PCB-180	M.A			0.035	M.A	0.12
SUM PCBs	4.083			4.904		

Table 2. Mean - Minimum - Maximum Concentrations (ng/lit) of the PCBs congeners in the Dissolved Water phase during the winter and summer of 1992 in the Gulf of Elefsis

	Concentrations - Winter			Concentrations - Summer		
	Mean	Mini.	Maximum	Mean	Mini.	Maximum
1. PCB-18	0.052	0.02	0.1	0.030	M.A	0.08
2. PCB-28	0.57	0.1	0.88	0.263	0.11	0.43
3. PCB-52	M.A			M.A		
4. PCB-101	0.173	0.06	0.5	0.166	0.05	0.5
5. PCB-153	0.687	0.078	1.23	0.585	0.053	1.65
6. PCB-138	0.031	M.A	0.115	0.02	M.A	0.028
7. PCB-180	M.A			M.A		
SUM PCBs	1.513			1.064		

Table 3. Mean - Minimum - Maximum Concentrations (ng/lit) of the PCBs congeners in the Sediments during the winter and summer of 1992 in the Gulf of Elefsis

	Concentrations - Sediments		
	Mean	Mini.	Maximum
1. PCB-18*			
2. PCB-28*			
3. PCB-52*			
4. PCB-101	7.59	0.53	17.00
5. PCB-153	16.5	3.1	34.5
6. PCB-138	17.7	2.4	13.1
7. PCB-180	13.35	1.65	30.4
SUM PCBs	55.14	7.68	119.5

Table 3. Mean - Minimum - Maximum Concentrations (µg/Kg, dry weight) of PCBs congeners in sediments. * Not identified due to the matrix interferences of the sample's background

Area	Concentrations - sediments		
	Average	Minimum	Maximum
Aegean Sea *	155	0.6	775
Coastal France & Spain*	85.5	0.2	15850
Northern Adriatic Sea*	24.1	N.D	332
Southeastern Med. Sea*	2.2	0.6	51.1
Gulf of Elefsis ** (present work)	48.05	7.68	119.5

* In most cases the concentrations have been expressed in comparison to Aroclor reference standards or as a concentration of decachlorobiphenyl (product of the perchlorination method)

** The total of PCBs has been expressed as a summation of all PCB congeners

Table 4. Average - Minimum - Maximum Concentrations of PCBs in sediments from different regions of the Mediterranean Sea (µg/Kg, dry weight)

Despite the fact that the maximum values determined in the Gulf of Elefsis are among the lowest included in the Table, the mean and especially the minimum values are particularly high. This reflects a generalised pollution due to the fact that the Gulf plays effectively the role of a trap of the pollution generated by the neighbouring industries and the sewage outfalls as a result of the geomorphology of the area.

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