

LEVELS OF HCB'S, ALDRIN, DDT'S, AND PCB'S IN SOME MARINE ORGANISMS FROM CASTELLON AND VALENCIA COASTS, SPAIN

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The content of organochlorine pesticides and PCB's in several molluscs, crustaceans and fishes were determined. This work is a part of the Mediterranean Pollution Monitoring Programme, MEDPOL, which was carried out during the months July, October and November of 1985.

The samples were collected from Vinaroz, Castellón, Burriana, Sagunto, Valencia, Cullera, and Gandía, and stored at -22°C. The organisms were classified, weighed and their length measured, and the several tissues separated, lyophilised, and homogenised for use in the analyses. Glass and metal material was used, after washing with twice distilled water, ethanol and hexane, and drying at 350°C for 12 hours.

The extraction of these compounds was carried out with hexane in Soxhlet for 5 hours, on 1-5 g of lyophilised organism mixed with equal quantity of anhydrous Na<sub>2</sub>SO<sub>4</sub>. The extract was then cleaned-up with conc H<sub>2</sub>SO<sub>4</sub>, and the hexane layer separated, and dried out in an evaporative concentrator. The residue was dissolved in 1 mL of hexane, and analysed by GC with electron capture detector, by using glass column with OV-17 1.5% and QF-1 1.95% on Chromosorb W-HP 80/100 mesh.

Alkaline hydrolysis with KOH-ethanol was used for identification of peaks. Quantification of peaks was performed by integration of areas, by using the external standard method. PCB's results are given with reference to Arochlor 1254 and 1260.

Precision and accuracy values were about 5% for PCB's and 10-16% for the remaining compounds.

The average values of organochlorine pesticides and PCB's in the marine organisms are given in Table 1. There were no significant variations either according to place or to time of year.

Highest levels of PCB's appear in fishes, and specially in *Tunnus thynnus* and *Sardina pilchardus*, which also present the highest concentrations of DDT's and HCB's; but generally the degree of pollution by organochlorine compounds can be considered low. The lowest levels of these compounds appear in crustaceans, in particular *Aristeus antennatus* and *Palaemon serratus*.

Moreover, by considering the average values, a general tendency to the increase in organochlorine concentration is observed in the different tissues of a same animal, in the order: muscle < digestive < liver, specially in *Aristeus antennatus*, *Mullus barbatus* and *Mullus surmuletus*.

CHLORINATED HYDROCARBONS IN RAINWATER OVER RIJEKA

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Studies of the occurrence of chlorinated hydrocarbons in atmospheric deposition and rainfall show that chlorinated hydrocarbons laden dust in the atmosphere was transported to Earth by sedimentation and rainfall (WELLS and JOHNSTONE, 1978). It is well known that the transport of chlorinated hydrocarbons from continental sources to the sea by sedimentation and rainfall is one of the most important sources of sea pollution. However, in available literature there are no data on such investigations in coastal or open waters of the Mediterranean Sea.

In the context of the ecological study of the Rijeka Bay a part of the investigation concentrated on the elucidation of the pollution extent and pollution sources of this area by persistent chlorinated hydrocarbons (PICER et al., 1981).

This paper deals with the results of the investigation on the concentrations of DDT and its analogous, dieldrin and polychlorinated biphenyls in rainwater samples collected over the city of Rijeka from June 1979 to May 1980. Rainwater was collected by using stainless-steel funnel. At the end of the collection period the material deposited in funnel was washed out mechanically by using glass wool, tap water and methanol. Rainwater samples were extracted with n-pentane and after the clean-up and separation of PCBs from organochlorine insecticides by using miniature silica gel column, eluates were analyzed by ECD gas chromatography. The results of the analysis for each collection period are given in Table 1. The PCB/DDT total ratios and percentages of p,p' DDT in the DDT<sub>total</sub> are also presented.

The discussion about the influence of meteorological conditions on concentrations of chlorinated hydrocarbons in rainwater and the prediction of annual contributions of chlorinated hydrocarbons deposited into the Rijeka Bay from the atmosphere are given.

REFERENCES

PICER M., N. PICER and B. NAZANSKY (1981). Persistent chlorinated hydrocarbons in the Rijeka Bay, *Thalassia Jugoslavica*, 17, 225-236.  
 WELLS D.E. and S.J. JOHNSTONE (1978). The occurrence of organochlorine residues in rainwater, *Water, Air and Soil Pollut.*, 9, 271-280.

Table 1. Chlorinated hydrocarbons in rainwater over Rijeka (concentrations in ng l<sup>-1</sup>)

Collection period	DDT <sub>total</sub>	Dieldrin	PCB	PCB/DDT <sub>total</sub>	% p,p' DDT of DDT <sub>total</sub>
27 June - 22 July 1979	2.01	0.12	1.3	0.65	64.2
9 Aug. - 4 Sept. 1979	1.15	0.02	3.7	3.22	84.3
15 Sept. - 25. Sept. 1979	1.16	0.04	4.7	4.05	70.7
12 Oct. - 6 Nov. 1979	0.82	0.07	3.8	4.63	18.3
9 Nov. - 18 Nov. 1979	0.88	0.07	1.4	1.59	79.5
9 Dec. - 30 Dec. 1979	1.79	0.07	10.1	5.64	72.1
5 Feb. - 7 Feb. 1980	2.40	0.06	12.2	5.08	69.6
7 March - 2 April 1980	0.69	0.02	2.8	4.06	81.2
8 April - 20 April 1980	1.63	0.02	2.6	1.59	87.1
28 April - 31 May 1980	1.12	0.03	2.8	2.50	67.9

ORGANISM	N.	I.	TISSUE	HCB	LINDANE	ALDRIN	DDDE	DDDD	opDDT	ppDDT	Ar 1254	Ar 1260
<i>Mytilus galloprovincialis</i>	17	56	b	0.9	1.2	0.7	14.5	5.5	4.6	21.9	51.3	45.2
<i>Venus gallina</i>	7	62	b	0.5	0.4	-	3.3	1.3	0.3	4.6	8.4	9.6
<i>Donax vittatus</i>	7	145	b	0.4	0.6	-	6.9	4.1	3.9	13.1	7.6	13.7
<i>Macropisus depurator</i> (M)	13	10	b	1.2	0.6	0.4	10.5	0.4	0.3	4.6	52.0	25.4
<i>Macropisus depurator</i> (F)	13	10	b	1.4	0.6	0.4	11.6	0.5	0.2	4.1	54.6	31.2
<i>Aristeus antennatus</i>	1	13	m	0.5	-	-	3.5	-	0.1	0.3	1.7	5.7
	1	13	d	2.2	8.7	-	26.6	4.6	3.9	22.9	14.4	16.5
	1	13	g	2.1	15.3	-	105.7	6.5	23.0	214	48.3	67.5
	8	11	g	1.1	1.8	-	131	0.9	22.8	27.2	28.0	53.0
<i>Palaemon serratus</i> (M)	1	12	m	10.7	12.1	-	1.8	-	-	-	27.9	30.9
<i>Palaemon serratus</i> (F)	2	15	m	1.2	0.7	-	4.1	0.1	0.5	2.8	19.4	24.6
<i>Sardina pilchardus</i>	17	7	m	6.1	3.1	0.3	56.0	25.9	1.1	15.7	139	124
<i>Mullus barbatus</i> (M)	4	4	m	3.6	4.1	0.1	29.7	0.4	-	5.9	110	70.4
<i>Mullus barbatus</i> (F)	4	4	d	4.9	1.6	0.1	18.9	5.1	-	23.7	149	61.9
<i>Mullus barbatus</i> (F)	4	4	l	3.6	7.6	0.05	32.5	36.3	-	19.6	221	116
<i>Mullus barbatus</i> (F)	4	3	m	1.0	0.8	0.1	22.8	1.1	-	8.2	87.7	59.1
<i>Mullus barbatus</i> (F)	4	3	d	4.8	4.0	0.1	22.3	13.0	-	19.3	159	66.2
<i>Mullus barbatus</i> (F)	4	3	l	2.9	4.0	0.3	29.3	28.5	-	21.6	221	116
<i>Mullus surmuletus</i> (M)	11	3	m	1.7	1.1	0.9	20.3	13.6	0.9	17.2	28.5	118
<i>Mullus surmuletus</i> (F)	4	3	d	0.9	9.8	-	9.1	5.5	1.0	11.5	32.8	53.6
<i>Mullus surmuletus</i> (F)	4	3	l	3.3	4.7	2.4	19.5	34.9	3.3	34.5	129	195
<i>Mullus surmuletus</i> (F)	6	2	m	2.4	7.3	0.8	19.2	4.2	1.1	12.3	79.6	186
<i>Mullus surmuletus</i> (F)	6	2	d	1.5	1.7	0.9	19.7	14.9	0.5	25.4	90.9	89.5
<i>Mullus surmuletus</i> (F)	6	2	l	5.3	4.2	2.4	33.4	43.8	1.2	39.7	269	183
<i>Tunnus thynnus</i> (F)	5	1	d	2.9	1.4	1.6	40.8	9.2	0.8	19.1	269	124
<i>Tunnus thynnus</i> (F)	4	1	g	4.5	2.5	4.3	39.1	6.2	-	12.1	166	90.0
<i>Tunnus thynnus</i> (F)	4	1	l	2.2	0.5	0.3	27.9	8.3	-	13.6	218	117
<i>Tunnus thynnus</i> (F)	4	1	g	3.2	1.0	0.1	17.0	8.0	-	19.7	169	75.8

n= number of samples; I= mean number of individuals for sample  
 b= whole body; m= muscle; d= digestive except liver; l= liver; g= gonads

Table 1.- Average values (in ng/g F.W.) of organochlorine pesticides and PCB's in marine organisms