WATER QUALITY ASSESSMENT OF THE VENICE LAGOON: TWO YEARS MONITORING OF POPs BY HIGH VOLUME SAMPLER

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Introduction

The results of a one year campaign for the determination of POPs in the water of the Venice lagoon were published in a previous paper[1]. This work represented the first application of a new sampling system for the detection at ultratrace levels of PCDD/F's, PCB's, HCB and PAH's in the Venice lagoon[2]. The results of this work revealed a marked spatial distribution among the different sampling sites in relation to the type and the level of POPs contamination.
In the present work the results of the second year campaign are presented. These data were compared with those of the first year in order to assess the reliability of this analytical technique and to verify the levels of contamination and the congeners distribution.

Methods and materials

Samples were collected during 2001 and 2002 in 16 sampling stations represented in Fig. 1. All stations were sampled twice, except station M. The high volume sample system used allowed to preconcentrate the compounds of interest on a glass fiber filter combined with an absorbing resin cartridge[3]. The samples were spiked with a series of 15 $^{13}C_{12}$-labeled 2,3,7,8 PCDD/F (EDF8999), 12 $^{13}C_{12}$-labeled PCB (EC4937), with $^{13}C_{12}$-HCB (CLM351) substituted isomers and 5 deuterated PAH (Acenaphtene-D10, Chrysene-D12, Naphtalene-D8, Perylene-D12, Phenanthrene-D10,) internal standards, and then extracted with dichloromethane and cleaned up. The HRGC/HRMS analyses were conducted using a HP 6890 plus gas chromatograph coupled to a Micromass Autospec Ultima mass spectrometer operating in EI mode at 35 eV and with a resolution of 10.000 (5% valley). The recovery always ranged between 55% and 105%. Reproducibility were 15% for lover value or better. The laboratory blank, repeated twice, where lower than 8% respect to the minimum concentration found[4].

Results and discussion

The total POP's concentration measured in the sampling stations in the different periods are reported in Table 1.

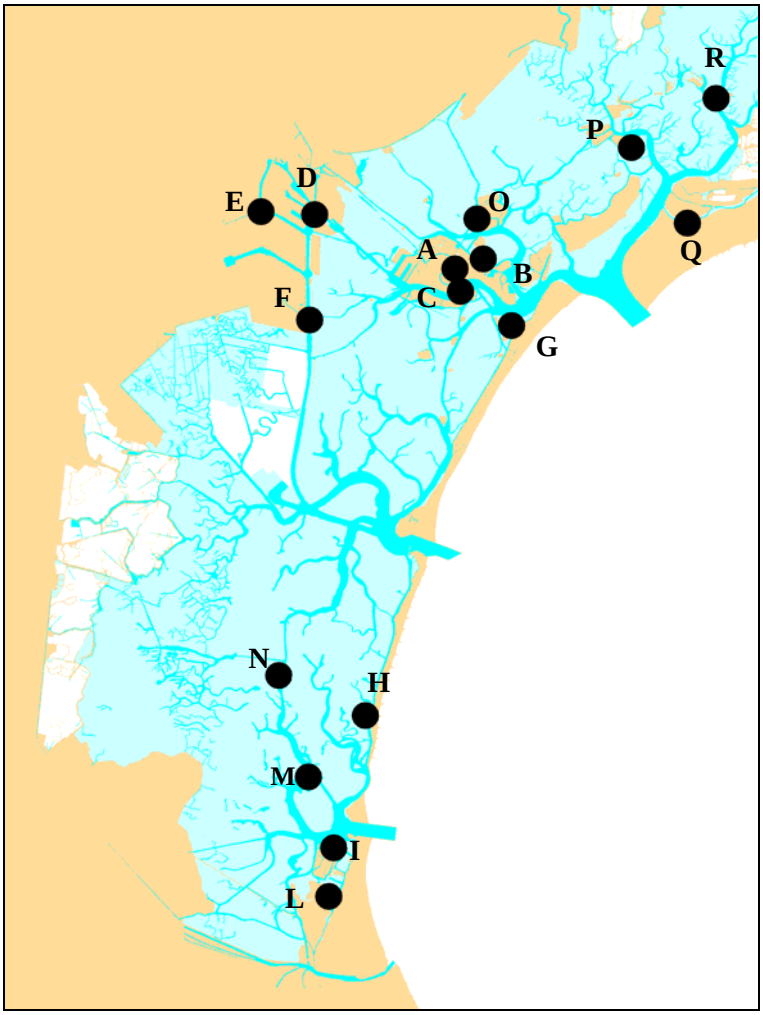

Fig. 1- Spatial distribution of the Magistrato alle Acque monitoring stations

Table 1 - Concentrations of POP's in the different stations of the Venice lagoon

Station		Date of sampling	PCDD/Fs	DL PCB's	Arochlor 1254+1260	HCB	PAH
			pg/l I-TE	pg/l WHO	ng/l	ng/l	ng/l
A	Canal Grande	16/11/01	0.26	0.04	2.48	0.090	190.41
		14/05/02	0.24	0.04	2.76	0.150	126.41
B	Fondamenta Nuove	05/02/02	0.08	< 0.01	0.39	0.020	26.30
		27/08/02	0.02	0.04	2.50	0.150	109.30
C	Punta della Salute	18/12/01	< 0.01	< 0.01	0.31	0.070	52.98
		11/09/02	< 0.01	< 0.01	0.30	0.003	3.36
D	Canale Industriale Nord	17/04/02	0.46	0.01	1.34	0.240	37.80
		15/11/02	0.34	< 0.01	0.85	0.125	23.06
E	Canale Industriale Ovest	15/11/01	0.18	0.01	2.58	0.310	173.80
		14/11/02	0.18	0.02	9.05	0.196	40.32
F	Punta Fusina	19/03/02	0.29	0.01	0.73	0.290	32.15
		11/12/02	0.25	0.01	0.73	0.293	25.90
G	S.M. Elisabetta	20/02/02	0.05	< 0.01	0.30	0.030	20.01
		15/10/02	0.07	< 0.01	0.28	0.007	182.26
H	Pellestrina	28/11/01	0.11	0.01	0.52	0.040	82.10
		15/05/02	0.04	0.01	0.60	0.030	26.54
I	Chioggia Vigo	06/02/02	0.04	0.01	0.47	0.020	116.13
		12/09/02	< 0.01	< 0.01	0.10	0.007	3.62
L	Chioggia Lusenzo	21/03/02	< 0.01	< 0.01	0.21	0.020	6.59
		06/02/03	0.05	< 0.01	0.20	0.026	52.32
M	Canale Perognola	21/02/02	0.03	< 0.01	0.09	0.020	7.76
N	Sette Morti	16/10/02	< 0.01	< 0.01	0.07	0.003	37.27
		11/04/03	< 0.01	< 0.01	0.04	< d.l.(*)	1.48
O	Murano	19/11/01	0.10	0.01	0.72	0.020	113.05
		17/05/02	0.20	0.02	1.21	0.030	38.92
P	Burano	08/02/02	0.05	< 0.01	0.35	0.030	68.16
		28/08/02	0.03	< 0.01	0.24	< d.l.(*)	5.80
Q	Ca' Savio	22/02/02	< 0.01	< 0.01	0.04	0.010	7.11
		13/09/02	< 0.01	< 0.01	0.11	0.005	1.60
R	Le Saline	18/04/02	< 0.01	< 0.01	0.08	0.020	8.34
		17/10/02	< 0.01	< 0.01	0.13	0.004	76.12

The results of Table 1 indicate that the distribution of different POPs are similar for the two years, both for the concentration levels and the congeners profile. In particular, the highest concentrations were found in the industrial area (Stations D, E, F) and in the Canal Grande of the city of Venice (Station A). The application of statistical methods such as principal component analysis (PCA) to the PCDD/Fs data set (Fig. 2) shows the specific behaviour of such stations and the limited temporal variability for all cases. In fact, cases relative to samples of the same stations in different periods have similar positions in the factorial space. Figure 2 confirms that the stations of the industrial area (especially D and F) are characterised by congeners profile with higher PCDFs/PCDDs ratio than other stations.

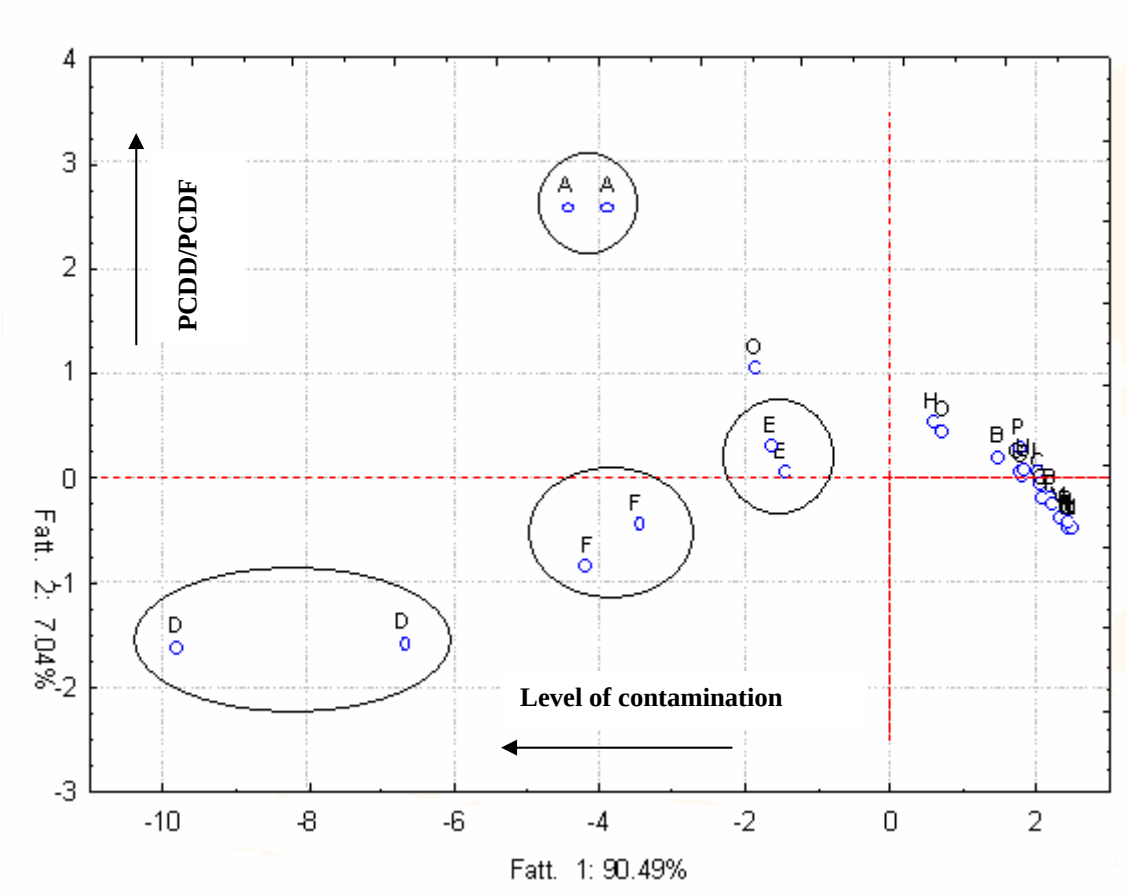

Fig. 2 – Principal component analysis for PCDD/Fs data set (2001 and 2002)

Conclusions

The results of the second campaign of measurements of the water quality of the lagoon of Venice confirmed the results of the first year, showing the good reliability of the adopted analytical method and the possibility to survey and characterise the distribution of pollution by POPs (PCDD/F's, PCB's, HCB and PAH's) in the venetian environment.

References

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