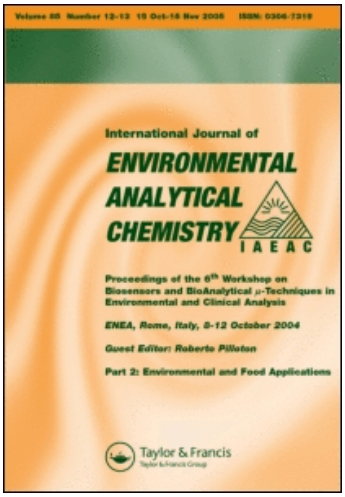

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DETERMINATION OF VOLATILE HALOGENATED COMPOUNDS IN TAP AND SURFACE WATERS FROM THE GDAŃSK DISTRICT

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The present method is based on preconcentration of organic contaminants on XAD-4 as sorbent, thermal desorption, mineralization and coulometric argentometric titration for the final determination of halides. The results were calculated as the total parameter VOX (volatile organic halogen) expressed as chlorine. The method has been used for the VOX determination in tap water, Vistula river water and Baltic Sea water. Sampling of the Baltic Sea water has been carried out during the research cruise of the *r/v* 'Oceania'. The relatively high anthropogenic pollution of the river Vistula (c_{VOX} = 11–45 μg Cl/cd^3), Gulf of Gdańsk (c_{VOX} = 0.6–4.5 μg Cl/dm^3) and the Pomerania Bay (c_{VOX} = 2 μg Cl/dm^3) has been determined. The VOX concentration in the tap water varied between 13 and 56 μg/dm^3; that is, this water is seriously polluted by volatile organic halogen compounds.

KEY WORDS: Water pollution, volatile organic halogen determination, solid sorbents.

INTRODUCTION

Volatile organohalogen compounds are at present among the most dangerous environmental pollutants due to their toxic, mutagenic and carcinogenic properties[1–7]. As a rule, these compounds do not occur in nature, hence their content is a measure of anthropogenic environmental pollution. Total parameters such as TOC (total organic carbon), TOX (total organic halogen), VOC (volatile organic carbon) and VOX (volatile organic halogen) can serve as indicators of the total contamination of the environment by organic compounds[6–8].

In the present study, we use preconcentration of organic contaminants on XAD-4 as the solid sorbent, thermal desorption and a final determination by coulometry after mineralization of the organic compounds. The model investigations and the statistical evaluation of the method have been described previously[9].

RESULTS

The present method[9] has been used for the VOX determination in tap, river and sea water from the Gdańsk district.

Table 1 VOX determination in tap water from Gdańsk Technical University of Gdańsk.

Sampling date	c_{VOX} [$\mu g\ Cl/dm^3$]	*Sampling date*	c_{VOX} [$\mu g\ Cl/dm^3$]
88.05.18	48.7	89.05.10	30.2
88.06.03	48.7	89.05.22	20.9
88.06.03	47.3	89.05.23	30.1
88.06.08	43.4	89.10.09	19.5
88.06.15	30.1	89.11.13	29.4
88.10.08	18.8	89.12.20	47.2
88.10.19	20.2	90.01.15	25.4
89.03.02	16.8	90.03.12	35.2
89.03.14	13.4	90.03.16	60.2
89.04.03	26.1	90.03.21	66.2
89.04.06	17.3	90.04.11	32.2

Table 1 lists the results of VOX determination in tap water from Gdańsk (Technical University of Gdańsk). Preconcentration of the analytes on the sorbent bed has been carried out directly at the sampling site. The final determination has been carried out in the laboratory.

Table 2 lists the results of VOX determination in Vistula river water and in sea water from the Gulf of Gdańsk (Gdynia-Orłowo quay, Sopot quay). Sampling of the Baltic Sea water has been also carried out during the research cruise of the *r/v* 'Oceania' (Figure 1). The results of VOX determination are compiled in Table 3. The preconcentration of the analytes on the solid sorbent bed has been carried out during the cruise and the final determination has been carried out in the laboratory. To check the total sorption of the analyte on the adsorption tube it is recommended to

Table 2 Determination of VOX in natural water from Gdańsk district.

Sample	*Sampling date*	*Sample volume* [dm^3]	C_{VOX} [$\mu g\ Cl/dm^3$]
River water,	88.05.26	5	16.3
Vistula at	88.05.26	5	17.6
Kiezmark	89.05.24	5	11.2
	90.04.04	5	40.2
	90.04.04	5	45.6
Sea water,	88.08.08	10	0.6
Gdynia-Orłowo quay	88.08.08	10	0.6
	89.05.11	10	4.5
	89.05.11	10	4.3
	90.04.19	10	4.3
Sea water,	88.07.01	10	0.7
Sopot quay	88.07.01	10	0.7
	89.10.25	10	1.3
	90.03.27	10	1.3

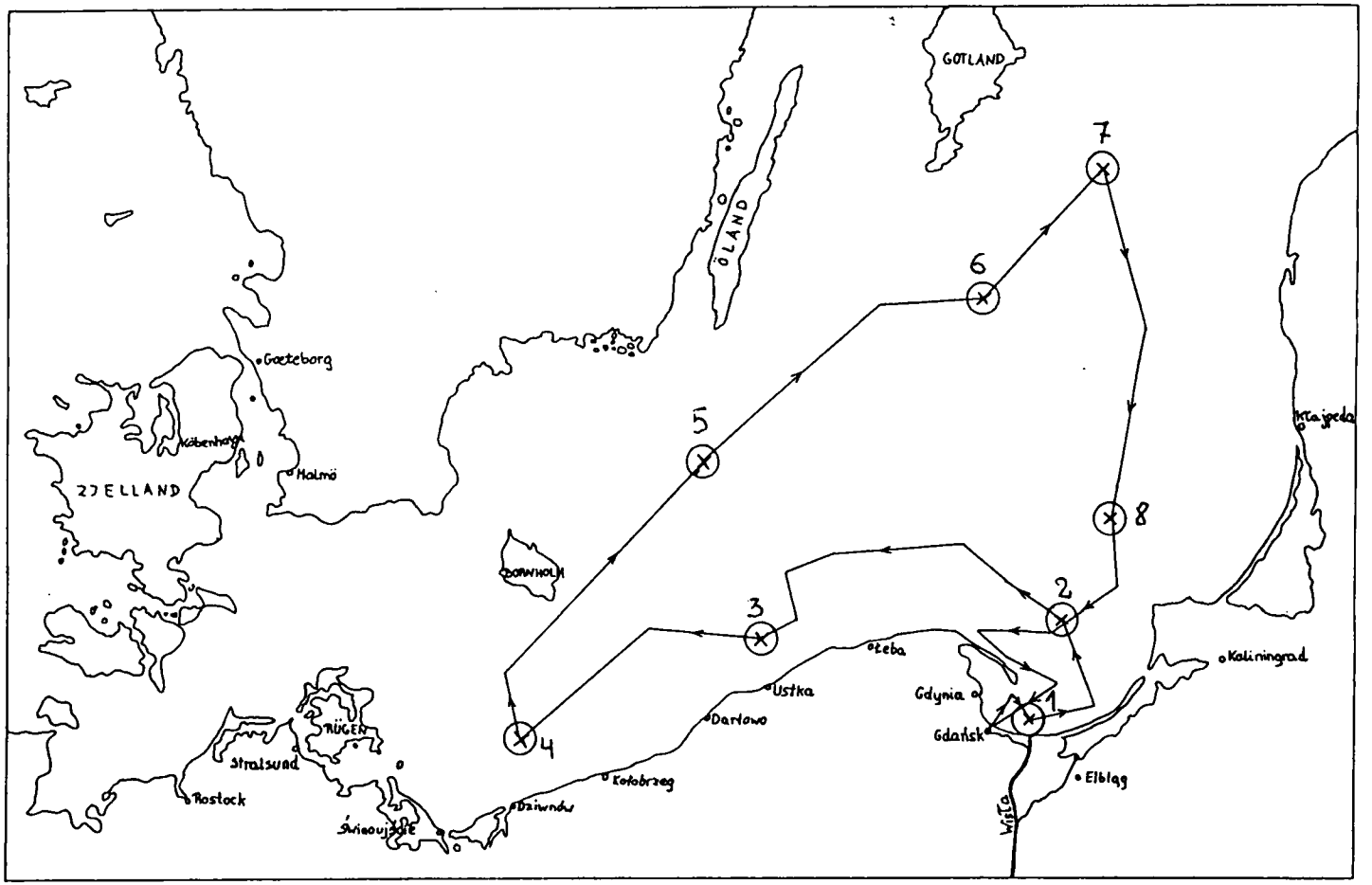

Figure 1 The research cruise of the r/v 'Oceania'; 1–8: the sampling sites.

Table 3 VOX determination in Baltic water during cruise of r/v 'Oceania'*.

Site	*Sampling date*	c_{VOX} [μg Cl/dm^3]
1	89.06.01	1.8
2	89.06.01	traces (ca. 0.2)
3	89.06.01	ND
4	89.06.02	2.0
5	89.06.03	ND
6	89.06.04	ND
7	89.06.04	ND
8	89.06.05	traces (ca. 0.1)

* Sites, see Fig. 1; sample volume, 10 dm^3.
** ND, not detected (<0.1 μg Cl/dm^3)

put a second tube after the first and to determine the VOX possibly sorbed on the second one.

CONCLUSIONS

The present method has been utilized for the VOX determination in samples of tap water, river water and sea water. It is very useful for the preconcentration of the analytes directly at the sampling site and for carrying out the final determination in a laboratory. The VOX values relate to that part of total organohalogen compounds which is sorbed on the XAD-4 bed and then thermally desorbed at 200°C. Depending on the range of analytes, the results obtained by thermal desorption can differ somewhat from those obtained by methods based on various headspace isolation techniques[12–16]. Therefore it would be interesting to perform an intercomparison of both methods. This problem is presently under investigations.

The anthropogenic pollution of the Vistula river, the Gulf of Gdańsk and the Pomerania Bay has been determined. The highest concentrations of VOX in sea water (ca. 2 μg Cl/dm^3) were found near the outlets of big rivers: the outlet of the Vistula—the Gulf of Gdańsk (site 1; Table 3 and Figure 1) and the outlet of the Odra—the Pomerania Bay (site 4; Table 3 and Figure 1). This corresponds with the relatively high VOX values found in Vistula water (11 ÷ 45 μg Cl/dm^3). The VOX value in the tap water varied between 13 and 56 μg Cl/cm^3, exceeding very often the maximum concentration limit recommended by, e.g., the West-German government. The VOX values vary strongly with the date of sampling and fluctuate during a day. The experimental values indicate that tap water from Gdańsk is seriously polluted by volatile organic halogen compounds.

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