Bull. Environm. Contam. Toxicol. 21,652-656 (1979)

PCBs and Organochlorine Insecticides in Oysters from Coastal Lagoons of the Gulf of Mexico, Mexico[1]

M. T. L. Rosales, A. V. Botello, H. Bravo,[3] and E. F. Mandelli[2]

Centro de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Apartado Postal 70-305, México 20, D.F., México, [3]Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México

Environmental contamination by organochlorine compounds is a matter of great concern. These compounds are known to be present in almost all environmental samples (GIAM at al. 1973). Oysters, in contrast to other motile marine organisms, must submit to whatever changes take place in their environment; consequently, they are able to accumulate in their tissues relatively high concentrations of toxic compounds present in the surrounding waters. The accumulation of DDT (p,p' - DDT ,p,p' - DDE and o,p'DDT) and other organochlorine compounds by the oyster Crassostrea virginica from coastal areas of the USA, has been reported by BUTLER (1973). This author indicated that DDT and dieldrin residues were measurable in 63 % and 15 % of the samples, respectively. PCBs residues, on the other hand, have been measured in a variety of marine organisms (HARVEY et al. 1974). However, very little information is available on the accumulation of these compounds by oysters. The purpose of this study was to determine baseline levels of PCBs and organochlorine insecticides in oysters from coastal lagoons of the Gulf of Mexico, Mexico.

MATERIALS AND METHODS

Specimens of Crassostrea virginica were collected during July and August of 1976 from nine different locations along the eastern coast of the Gulf of Mexico (Fig. 1). The oysters were found in dense clusters on soft muddy bottoms; an average of one hundred individuals were collected from each location. The oysters were frozen within a few hours after being collected and sent for analysis to the Centro de Ciencias del Mar y Limnología in Mexico City.

The following procedures were performed on the samples: the shells of the animals were cleaned and each animal was measured and weighed (the anterior posterior dimensions of the animals varied from 50 to 100 mm), the soft parts were homogenized in a Waring blender,

1. Contribution 172 of the Centro de Ciencias del Mar y Limnología, UNAM.
2. UNESCO/UNDP.

0007-4861/79/0021-0652 $01.00
© 1979 Springer-Verlag New York Inc.

MONS 001438

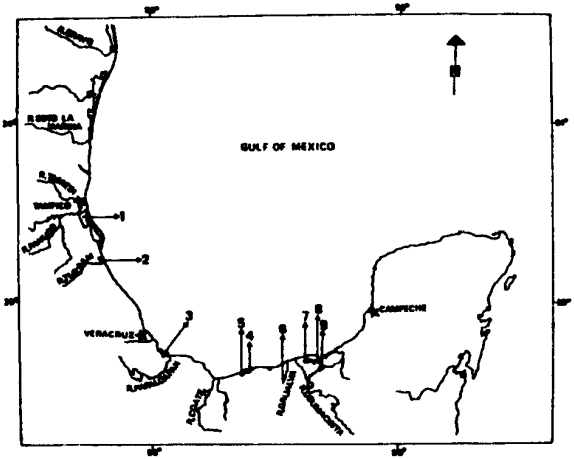


Fig. 1 Sampling sites: 1. Pueblo Viejo Lagoon, 2. Tampamachoco Channel, 3. Alvarado Lagoon, 4. Machona Lagoon, 5. Carmen Lagoon, 6. Tamulte Estero, 7. Puerto Rico Lagoon, 8. Terminos Lagoon (Boca de Atasta), 9. Terminos Lagoon (Pallzada Vieja).

the homogenates were freeze-dried, and the dried materials were stored in throughly cleaned wide mouth glass jars. The extraction procedure of ROSEN and MIDDLETON (1955) was conducted on 5 g of the dried samples using 200 mL of iso-octane in a Soxhlet extractor for about 12 h.

PCBs were quantitated by the method of WEBB and McCALL (1973). The analyses were carried out on a Hewlett Packard Model 5713 gas chromatograph equipped with an integrator Autolab System 4. Ten microliters of the samples were injected onto a 1.8 m x 3.5 mm I.d. glass column packed with 3 % OV-101 on Chromosorb W/HP (80/100), under the following conditions: column temperature 188°C isothermal, carrier gas a mixture of 5% methane and 95% argon, flux rate 75 mL/min, injector temperature 250°C, detector temperature 300°C

MONS 001439

For the analyses of organochlorine insecticides, the iso-octane fractions were evaporated to 1.5 - 2.0 mL and passed through Florisil columns to remove PCBs interferences (CANADA CENTRE FOR INLAND WATERS, ANALYTICAL METHODS, 1974). Each fraction was quantitated for organochlorine insecticides by injection onto 1.8 m x 3.5 mm i.d. glass columns packed with 1.5 % OV-17 + 1.95 % QF1 on Gas Chrom Q (80-100) and 4 % OV-101 + 6 % OV-210 on Gas Chrom Q (80/100) under the following conditions: column temperature 200°C isothermal, carrier gas a mixture of 95 % argon + 5 % methane, flux rate 60 mL/min, make-up gas a mixture of 5 % methane + 95 % argon (20 mL/min), injector temperature 220°C, detector temperature 300°C. The integration of the peaks was made with an Autolab System I. All the results are reported in ug/kg (ppb) on wet weight basis.

TABLE 1

Total PCBs content in oysters from coastal lagoons of the Gulf of Mexico, Mexico

Site	Location Let.	Long.	PCBs (ppb)
1	22°10'	97°53'	75
2	21°30'	97°26'	20
3	18°46'	95°45,9'	72
4	18°20,9'	93°38'	14
5	18°17'	93°47,5'	90
6	18°13'	92°38'	81
7	18°39'	91°56'	48
8	18°32'	91°51,5'	75
9	18°25,8'	91°46,5'	19

RESULTS AND DISCUSSION

As far as we know, prior to this study, no systematic studies on the presence of organochlorine compounds in marine organisms from coastal lagoons of the Gulf of Mexico, Mexico have been reported.

The results of this study are given in Tables 1 and 2. PCBs were found in all the samples analyzed, indicating that these compounds are widely distributed in the eastern coast of the Gulf of Mexico. The concentration of PCBs in oyster tissues ranged from 14 to 90

MONS 001440

ppb, with the lowest values determined in oysters from coastal lagoons located in very sparcely populated areas (sites, 2, 4 and 9).

PCB concentrations, ranging from 72 to 90 ppb, were determined in oysters from areas affected by human activities, such as sites 1, 3, 5, 6 and 8. The paucity of data on PCB levels in oysters from the Gulf coast makes the identification of typical background values difficult.

BUTLER (1973) identified the presence of PCBs in Crassostrea virginica from few estuaries of the eastern and Gulf coasts of the USA; in most of the cases, these compounds were not quantified. However, values ranging from 390 to 2800 ppb were given for oysters from Chesapeake Bay, Virginia, USA.

DDT and dieldrin were present in most of the oysters analyzed in this study, other organochlorine compounds were infrequently detected or found at low levels. DDT, with its analogs, occurred in concentrations ranging from 6 to 28 ppb with a mean value of 15 ppb. Dieldrin, on the other hand, was also detected in most of the samples with concentrations ranging from 0.03 to 1.1 ppb.

TABLE 2

Total Concentration of Organochlorines in Oysters from the Different Sites (ppb)

Site	Total DDT	Dieldrin	Endrin	γ-Chlordane	β-Endosulfan
1	16	-	-	0.10	0.06
2	-	1.1	-	-	-
3	9	0.3	0.03	-	-
4	-	0.5	-	-	-
5	17	-	-	0.10	0.06
6	28	0.2	-	0.09	0.06
7	-	3.3	-	-	-
8	11	0.03	-	-	0.4
9	6	-	-	-	-

MONS 001441

The highest DDT and dieldrin values were detected in oysters from areas affected by agricultural practices.

BUTLER (1973) reported the results of a survey conducted from 1965 to 1972 on the presence of organochlorine compounds in oysters from 15 coastal states of the USA. This author found DDT residues in 63 % of the samples with levels ranging from < 11 to > 1000 ppb, while dieldrin was detected in 15 % of the samples with levels ranging from < 5 to > 200 ppb.

Levels of organochlorine compounds determined in the oysters from the Mexican coastal lagoons were comparatively low. Because the number of samples analyzed for each location was small, no firm conclusions can be made at this time. It will be of interest to continue the monitoring of these compounds through the years, since there is no effective restrictions in their use in Mexico.

ACKNOWLEDGEMENTS

The authors acknowledge the technical assistance of Dr. B. Afghan and Dr. I. Onuska of the Canada Centre for Inland Waters, Burlington Ontario, Canada.

REFERENCES

BUTLER, P.A.: Pesticides Monit. J. 6, 238 (1973).

CANADA CENTRE FOR INLAND WATERS, Analytical Methods Manual. Burlington, Ontario (1974).

GIAM, C. S., M. K. WONG, A. R. HANKS, W. M. SACKETT and R. L. RICHARDSON: Bull. Environ. Contam. Toxicol. 9, 376 (1973).

HARVEY, G. R., H. P. MIKLAS, V. T. BOWEN and W. G. STEINHAUER: J. Mar. Res. 32, 103 (1974).

ROSEN, A. A. and F. M. MIDDLETON: Anal. Chem. 27, 790 (1955).

WEBB, R. G. and A. C. McCALL: J. Chrom. Sci. 11, 366 (1973).

MONS 001442