Distribution of organochlorine compounds in sediments from the coastal zone and Bank of Campeche, Mexico

Jaime Rendon Von Osten[1], Rodolfo E. Del Río-Rodriguez[2], Martín G. Memije-Canepa[2]

[1]Universidad Autonoma De Campeche
[2]Centro EPOMEX-UAC

Introduction

In 1987 Environmental Board Ministries of Mexico conformed a commission with the aim of controlling the use of toxic substances such as pesticides. In 1990, the commission (CICOPLAFEST) banned the use of six organochlorine compounds (OC´s), and also DDT use was severely restricted. Although organochlorine production and use underwent a steady decline and DDT was limited to sanitary campaigns (about 3,000 tons per year) the residues of these compounds still remain in the environment. OC´s released into the aquatic environment can be attached to the surface of sediment particles and be buried along with the sediments and thus create submerged pools of contaminants. These compounds can then be released back to the water column under particular circumstances, such as anoxic conditions; sediments containing organic carbon could release contaminants into the surrounding water. [1] The former process makes the pollutants available mainly for the benthic fauna. Contaminated sediments can become a source of pollution, and therefore the periodic evaluation of this compartment is important. Organochlorine compounds (OC´s) has been studied in Mexico in terrestrial and aquatic substrates. [2] However, there is a lack of information on residues in marine ecosystems. The coastal zone of Campeche and its Bank are among the most productive ecosystems mainly for shrimp fisheries, therefore the objective of this study was to determine the current state of organic pesticide pollution in the marine and coastal sediments from Campeche State circumscribed to the main coastal and offshore distribution areas of one of the most economically important shrimp species *Farfantepenaeus duorarum*.

Materials and Methods

The analysis of sediments included organochlorine pesticides and the percentage of organic carbon distributed in both areas - marine and coastal zone. The sediment samples were obtained by using a Van Veen dredge; sediment collection was carried out during the three climatic seasons, locally determined as rainy season (July, 2003), “nortes” (November, 2003) and dry season (March, 2004). Sediment was collected in 9 sampling stations offshore and 8 inshore stations. The analytical procedures used for the extraction, purification and quantification of the chlorinated hydrocarbons in sediments were followed according to those recommended by UNEP/FAO. [3] The sediments were extracted with 200 ml of hexane for 8 hours in a soxhlet apparatus and the extracts were reduced to 2 ml by means of a rotovapor prior to fractionation using chromatography columns (15 cm long. and 3 cm, ID) packed with florisil and eluted with hexane and a mixture of hexane-methylene chloride. The concentrated was analyzed by gas chromatography with capillary columns (Varian 3800, 30 m x 0.25 mm ID x 0.25 µm bonded 5% phenyl-methylsilicone, fused silica columns). A mixture of 15 chlorinated hydrocarbons was used as an external standard. Recovery yields were up to 92%. The percentage of organic matter in sediments was determined by titration using Gaudette *et al*. method. [4]

Results and Discussion

In general, the percentage of organic matter in sediments was 3 times higher in sediments from the coastal zone (0.69 %) than the marine area (0.22 %). The main compounds detected in sediments were p,p´-DDE and p,p´-DDT and the average concentrations were 0.15 and 1.16 ng g^{-1} from both areas, respectively, Almost 90% of OC´s detected is DDT. During Nortes season, OCs were only detected in coastal stations with a ΣDDT average of 1.09 ng g^{-1}. The highest concentrations were found mainly in station C3 (ΣDDT = 1.4 ng g^{-1}) which is situated close to a cane crop settlement where the runoff could contribute to the pollution. Pesticide concentration in this particular area could be influenced by wind patterns that could remove, transport and deposit residues linked to particles into the coastal zone, and to the runoff from the surrounding agricultural land. [5] During dry and rainy seasons p,p'-DDE residues were detected at 3 out of 9 marine stations in identical average concentrations of 0.11 ng g^{-1}. In contrast, OC´s were detected at only one coastal station during those seasons (C3 dry season, and C8 rainy season), although in higher concentrations (ΣDDT = 0.9 ng g^{-1}) than offshore stations (ΣDDT = 0.1 ng g^{-1}). Atmospheric deposition in North

America has been demonstrated [6] and probably the residues found in the Campeche Bank are deposited by this pathway. Due to OC´s chemical stability, estrogen-like characteristics and potential toxicity to crustaceans, [7] it is imperative to evaluate the possible adverse effects on fisheries, mainly pink shrimp (*F. duorarum*) as it is one of the most economically important species.

Acknowledgements
This study was supported by CONACyT (Consejo Nacional de Ciencia y Tecnologia de Mexico), Project 36780-B

References

1. Skei J., Larsson P., Rosenberg R., Jonsson P., Olsson M. and Broman D. (2000) *Ambio* 29:184-194.
2. Albert L. (1996) *Rev Environ Contam Toxicol*. 147: l-44.
3. UNEP/FAO/IAEA (1982) Reference Methods for Marine Pollution Studies. No 17. Determination of DDT's and PCB's and other hydrocarbons in marine sediments by gas liquid chromatography.
4. Gaudette H., Flight W., Toner L. and Folger D. (1974) *J Sedim Petrol*. 44:249-253.
5. Brasher A. and Wolff R. (2004) *Arch Environ Contam Toxicol*. 46(3):385-398.
6. Shen L., Wania F., Lei Y., Teixeira C., Muir D. and Bidleman T. (2005) *Environ Sci Technol*. 39:409-420.
7. Huang D., Wang S. and Chen H. (2004) *Chemosphere* 57:1621-1627.