Marine Pollution Bulletin xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Baseline

Heterogeneous distribution of polycyclic aromatic hydrocarbons in surface sediments and red mullet along the Spanish Mediterranean coast

V.M. León *, I. García, C. Martínez-Gómez, J.A. Campillo, J. Benedicto

Instituto Español de Oceanografía, Centro Oceanográfico de Murcia, Apdo. 22, C/Varadero 1, 30740 San Pedro del Pinatar, Murcia, Spain

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Polycyclic aromatic hydrocarbons
Surface sediment
Red mullet
Western Mediterranean
Bioaccumulation
Distribution

ABSTRACT

The spatial distribution of polycyclic aromatic hydrocarbon (PAH) concentrations was characterised in surface sediments and red mullet from eleven Iberian Mediterranean coastal areas. Mean PAH concentrations ranged from 28 to 1006 and from 3 to 40 μg kg^{-1} d.w. in sediment and red mullet muscle, respectively. The highest PAH concentrations in sediments were detected close to main ports and urban nuclei. However, concentrations of PAHs in red mullet showed little correspondence with PAH concentrations of the sediments due to its metabolic capacity. Phenanthrene was the predominant homologue in red mullet, whereas fluoranthene, pyrene and benzo(b)fluoranthene were the most abundant ones in sediments.

Significant correlations between PAHs and organic carbon or fine fraction in sediments were only found in some areas. PAH concentrations in sediments were lower than environmental criteria in the majority of cases, except for benzo(g,h,i)perylene in 25% of samples from the Barcelona coastal area and for several homologues close to the port of Sagunto.

Polycyclic aromatic hydrocarbons (PAHs) are of special concern in the marine environment due to their widespread distribution and to the mutagenic and carcinogenic properties of their homologues, among other cytotoxic properties (White, 1986; Vethaak et al., 1996; Lyons et al., 1997; Vincent et al., 1998), with some of their metabolites displaying estrogenic activity (Van Lipzig et al., 2005; Martínez-Gómez et al., 2013). Although the main source of PAHs is the incomplete combustion of organic matter at high temperatures, other sources, such as the release of oil (oil spills, tanker ballasting/deballasting operations, etc.) or diagenetic processes (Neff, 1979), can also have a significant impact on the environment. These compounds are ubiquitous marine sediment contaminants as a consequence of their continuous access to this system through atmospheric deposition, transport in particulate and dissolved phases in groundwater and rivers, urban or industrial wastewater discharges and maritime transport spills, amongst others. In the environment, PAHs tend to be sorbed by particulate material (either biotic or abiotic) as a consequence of their hydrophobicity (high log Kow) (Pignatello and Xing, 1996), showing concentrations in particulate material that are often several orders of magnitude greater than dissolved levels (Baumard et al., 1998b). Consequently, as the bioaccumulation of a pollutant is governed by its bioavailability, organisms are often enriched in low molecular weight PAHs in relation to sediment (Baumard et al., 1998b). Marine sediments can act as both a sink and a source of pollutants in the marine environment. If particles are ingested or the sediment-associated PAHs are otherwise released, they may be transferred to biota (Forbes and Forbes, 1998; Eggleton and Thomas, 2004).

The distribution of PAHs in fish tissues is governed by diet composition, biotransformation processes and above all their bioavailability (Baumard et al., 1998c). Thus, since vertebrates have a higher capacity to metabolize and excrete PAHs than molluscs, PAHs will tend to bioaccumulate more in the latter than in the former (Meador et al., 1995). In fact PAH levels in bivalves are commonly used as a bioindicator of their presence in the coastal water column (Baumard et al., 1998a, 1999; León et al., 2013a,b). PAH levels in benthic fish tissues contribute to our knowledge of the bioaccumulation pattern of these compounds in different fish species and may provide relevant information for the associated human consumption risks of contaminated fish (Dhananjayan and Muralidharan, 2012).

The characterisation of PAHs distribution and their temporal trends in sediments and biota are included in the international marine monitoring programs (MED POL, OSPAR, etc.). Within that context, a network to assess chemical pollution (trace metals, organochlorinated pollutants and polycyclic aromatic hydrocarbons) in sediment and marine target species (mussels and red mullet) has been developed over the last decade along the Iberian

* Corresponding author. Tel.: +34 968179410; fax: +34 968184441.
E-mail address: victor.leon@mu.ieo.es (V.M. León).

http://dx.doi.org/10.1016/j.marpolbul.2014.07.049
0025-326X/