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Polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) in sediments from an urban- and industrial-impacted subtropical estuary (Babitonga Bay, Brazil)



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ABSTRACT

Babitonga Bay is a large estuary, which has been under pressure from anthropogenic activities coexisting with a natural area of Atlantic rainforest and mangrove systems. The concentration of persistent organic pollutants (POPs), such as polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) was determined to evaluate the contamination status and the determine possible pollution sources in the estuary. The \sum DDT (sum of DDT, DDE and DDD concentrations) was the predominant OCP group, with concentrations ranging from <DL (below detection limit) to 122 ng g^{-1} . The exceptionally high concentration of p,p'-DDT (80%) found near São Francisco harbour exceeded SQG limits indicating highly toxic conditions in the area that may be attributed to a recent contamination from some local input. In contrast, other sites in the estuary presented higher concentration of the metabolite p,p'-DDE (34%). The results suggest strongly anthropogenic impact in specific sites of this estuary, which need further investigation.

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Polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs), were released in coastal and marine ecosystems since those compounds had been used in the past for industrial and agricultural purposes and for the control of disease-transmitting vectors, such as malaria, in developing countries (Shaw et al., 2005; Van Dyk et al., 2010). In Brazil, although the production and use of these compounds has been banned, considerable amounts of PCBs and OCPs may be stored in waste dump areas without any methods of control (Penteado and Vaz, 2001).

Human activities may still release PCBs and OCPs into the environment, such as the maintenance of electrical equipment, re-use of fluids, demolition of buildings, recycling operations, incineration of industrial and domestic products, inadequate waste disposal and illegal discharges (UNEP, 1999).

As sediments may receive these pollutant discharges, trapping and accumulating contaminants over time, this compartment is widely recognized as important natural reservoir and large environmental sink and is used for evaluating the health of aquatic ecosystem (Secco et al., 2005; Cesar et al., 2007; Martins et al., 2012).

Babitonga Bay (26°16'S; 48°41'W) is one of the most important estuaries of Southern Brazil. It covers an area of 1400 km² where

agriculture, shellfish farming and industries coexist with a unique natural area of Atlantic rainforest and mangrove systems (Grace et al., 2008). This area is located northeast of Joinville City, the most industrialized and urbanized area of the South Atlantic, which has a permanent population of 620,000 inhabitants and a large industrial area with approximately 1600 industries (Barros et al., 2010; IBGE, 2012). Economic activities that developed inside the estuary are related to the São Francisco do Sul and Itapoa harbours, fishing and oyster farming (Vieira et al., 2008).

Due to the economic importance of Babitonga Bay and based on the lack of information about the occurrence and sources of OCs in this coastal area, this study aimed to evaluate OCP and PCB contamination in sediments from Babitonga Bay, a subtropical estuary located in SW Atlantic that is impacted by urban and industrial pollution, contributing with valuable information to a global and regional inventory of organochlorine compounds. The spatial distribution of POPs was evaluated considering the proximity of anthropogenic and industrial activities and the geochemical characteristics of sediments analysed.

To evaluate the occurrence and spatial distribution of PCBs and OCPs in Babitonga Bay, 19 sediment samples were collected in March 2012 (Fig. 1) using a stainless steel grab sampler (surface area: 0.04 m²). The top 2 cm of the undisturbed surface sediment was placed into pre-cleaned aluminium foil and stored at – 20 °C. The sediments were

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