

Polybrominated Diphenyl Ethers (PBDEs) in Goby (Gobius spp.) and Sole (Solea solea) from Thermaikos Gulf, Greece

Ioannis Dosis

Laboratory of Ecology and Protection of the Environment, Thessaloniki, Greece
Email: dosis_i@yahoo.com

Abstract

The mass fractions of polybrominated diphenyl ether (PBDE) were calculated in samples from two benthic fish species, goby and sole, from the Thermaikos Gulf in north Greece. A well-known cold extraction procedure was used to evaluate the samples. For goby and sole, the average total (PBDE) was 8.98 to 35.00 ng g⁻¹ lipid weight (lw) and 12.36 to 163.26 ng g⁻¹ lw, respectively. Significant differences were observed between samplings but not between the two species. Thermaikos Gulf was classified as low polluted or comparable with regard to similar areas worldwide; however, the notable mass fraction increase in some cases as well as the increasing temporal trend of PBDE levels established for both species signify the need for further monitoring. Congener profiles showed dominance of penta-/octa-BDEs (50-70% from Σ PBDEs) and the presence of deca-BDE as well (18-19%). Congener correlation analysis suggested different pollution sources between higher and lower brominated congeners, as well as different metabolic/degradation processes. Calculations of bioaccumulation factors (BSAF) highlighted the influence of congener bromination degree on the bioaccumulation potential

Keywords: Brominated flame retardants (BFRs); Aquatic ecosystem; Bioaccumulation; Benthic species; Environmental pollution monitoring; Congener profile

INTRODUCTION

Polybrominated diphenyl ethers (PBDEs) are brominated flame retardants (BFRs) that are widely used in a variety of commercial and household products, such as plastics, construction materials, foams, electronic equipment, and so on, to reduce the risk of these products igniting or to slow down the burning process. PBDEs form a group that consists of 209 congeners and have similar molecular structure to persistent organic pollutants [Polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins (PCDDs), etc.] Which also suggests an ubiquitous environmental presence in every level of the trophic chain due to their properties such as environmental persistence, lipophilicity, bioaccumulation and resistance to degradation. Recent investigations in the marine food chain have revealed that PBDEs can be transferred via the trophic levels.

PBDE contamination can occur directly through the use and disposal of PBDE commercial items, as well as through leaching/volatilization, or indirectly through other pathways (such as air, soil, or water transport). PBDEs were found in a variety of aquatic creatures, as well as other environmental markers and human bodies. Adverse toxicological effects through bioaccumulation/ bio magnification, linked to the immune and reproductive systems have been reported both for humans and wildlife. Fish and shellfish consumption constitute one of human's major exposure route

The presence of large quantities of PBDEs in the marine environment in benthic fish shows that the abiotic environment has a substantial impact on their bioaccumulation mechanisms. Pollution levels in fish are typically high among aquatic animals, however European levels were found to be significantly lower than those in North America. For two benthic fish species (Gobius spp. & Solea solea) from Thermaikos gulf, PBDE mass fraction levels, congener profiles, and temporal trends were estimated in this study. Pollution levels were compared to worldwide reported statistics and possible discrepancies in mass fractions between the two species were studied. According to the Provisional Tolerable Weekly Intake (PTWI) developed by the European Food Safety Authority (EFSA) for PBDEs, bioaccumulation factors were estimated to assess the potential harm to public health from intake of these two edible species of fish. To the best of the authors' knowledge, this is the first set of data on PBDEs in fish from the Thermaikos Gulf region.