Accumulation of DDTs, Heavy Metals and PBDEs in Fish Collected from Fish Ponds and Mariculture Zones of the Pearl River Delta, China

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Abstract

Muscles and livers of 6 species of freshwater fish collected in fishponds in Shunde and Zhongshan and 4 species of marine fish collected in 6 different mariculture farms in Hong Kong (Tung Lung Chau, Ma Wan, Cheung Chau and Kat O) and China (Daya Bay and Shenzhen) were analyzed for DDTs, heavy metals and PBDEs. Feeds and sediments were also sampled for analysis. It was found that total DDTs concentrations in freshwater fish flesh decreased in the order of carnivores (1742 µg/kg lipid wt.) > herbivores (165 µg/kg lipid wt.) > omnivores (42.5 µg/kg lipid wt.) in which the highest concentration was detected in mandarin fish (*Siniperca chuatsi*) (2641 µg/kg lipid wt.). Muscles of snubnose pompano (*Trachinotus blochii*) and orange-spotted grouper (*Epinephelus coioides*) in Ma Wan contained elevated levels of total DDTs (2590 and 2034 µg/kg lipid wt. respectively). Moreover, trash fish feed used in both freshwater fish pond and marine fish farms (86.5.641 µg/kg lipid wt.) contained significantly higher levels (p<0.05) of DDTs than those of commercial pellets but correlations between fish feed and muscle were not significant. The elevated BSAF for tilapia (*Tilapia mossambicus*) (24.1) suggested that accumulation of DDTs from sediment to tilapia was evident.

Heavy metal investigation illustrated that Zn was the most abundant elements found in fish muscles while fish livers generally accumulated higher amounts of heavy metals than muscles except As in freshwater fish. Elevated concentrations of
heavy metals detected in sediments showed that it could be served as large sink for heavy metals in the water system although correlations between heavy metal concentrations in sediment and fish muscle was not significant \((p>0.05)\). Contrarily, high levels of As were detected in muscles of freshwater fish and trash fish used as feed. The concentrations of As in muscles were also significantly \((p<0.01)\) correlated with corresponding feeds, including trash fish \((r^2 = 0.999)\) and commercial pellets \((r^2 = 0.755)\).

The average concentrations of total PBDEs in freshwater fish decreased in the order of herbivores \((332 \, \mu g/kg \, lipid \, wt.) \) > omnivores \((151.5 \, \mu g/kg \, lipid \, wt.) \) > carnivores \((113.5 \, \mu g/kg \, lipid \, wt.)\), among which bighead carp (cultivated with pig manure) contained the highest level of PBDEs \((538 \, \mu g/kg \, lipid \, wt.)\). In addition, marine fish from Kat O \((143 \, \mu g/kg \, lipid \, wt)\) were more contaminated by PBDEs than those in other mariculture farms. The varied BDE congeners distributions in sediment, fish feed and fish muscle revealed that sediment and feed may not be the source of PBDEs contamination in fish in the present study.
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