

# **An Assessment of Chemical and Microbial Contamination of Some Selected Seafoods Landed on the Ghana Coast**

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## **ABSTRACT**

Seafood consumption is an important route of human exposure to organic and inorganic contaminants as well as microbes. Fish tissues from three (3) commonly consumed seafoods obtained from seven fishing landing sites along the coast of Ghana between August and October, 2009. The seafoods included *Sardinella maderensis*, *Selene dorsalis* and *Sepia officinalis* from Half Assini, Elmina, Apam, Winneba, Chorkor, Tema and Adina landing sites. Seafood were analysed for Polychlorinated Biphenyls (PCBs), Organochlorine pesticide residues (OCPs), trace metals and microbial load with the aim to further our understanding of bioaccumulation, and to reflect the hygienic state and the chemical contamination of the different landing environments along the coast of Ghana. Eight (8) congeners of PCBs that were investigated were PCBs 28, 52, 101, 118, 138, 152, 153 and 180 using Gas Chromatography -Mass Spectrometry (GC-MS). The mean concentrations of PCBs ranged from below detection limit to  $4.82 \pm 0.14$  ng/g wet weight. Only PCB 28, showed significant difference ( $p < 0.05$ ) among the species. *S. officinalis* recorded the highest mean concentration of  $0.78 \pm 0.16$  ng/g wet wt. for all PCBs. This was followed by *S. dorsalis* (mean concentration of  $0.74 \pm 0.18$  ng/g wet wt.) and then *S. maderensis* (mean concentration of  $0.55 \pm 0.14$  ng/g wet wt.). The mean concentrations of all PCBs were generally below the WHO limits of  $2.00 \mu\text{g/g}$  wet wt. It is thus, an indication of less contamination of the marine biota of the Ghanaian marine environment with PCBs. The PCBs 153 and 180 were observed to show some interreaction in all three seafood species. Fifteen (15) of the OCPs were detected in all samples analysed using GC-MS method. They included the HCH isomers ( $\mu$ -B- and  $\gamma$ -HCHs), heptachlor, methoxychlor,  $\gamma$ -chlordane, endosulfans ( $\alpha$ -endosulfan sulphate,  $\alpha$ -endosulfan and  $\beta$ -endosulfan), aldrin, endrin, dieldrin and p,p'-DDTs (p,p'-DDT, p,p'-DDD and p,p'-DDE). The mean concentrations of all OCPs were from below detection limit to  $10.20 \pm 0.20$  ng/g wet wt. OCPs were grouped based on their related parent chemicals, ingredients, by-products, metabolites, and molecular weight. Whilst the highest concentrations of  $\mu$ -HCHs ( $1.34 \pm 0.24$  ng/g wet wt.),  $\alpha$ -ENDOSULFANS ( $1.62 \pm 0.52$  ng/g wet wt.) and  $\alpha$ -DRINs ( $0.44 \pm 0.10$  ng/g wet wt.) and  $\alpha$ -DDTs ( $0.81 \pm 0.16$  ng/g wet wt.) were found in *S. officinalis* samples, the highest concentrations of LCHLORS ( $2.44 \pm 0.80$  ng/g wet wt.) were detected in *S. dorsalis*.  $\beta$ -HCH,  $\gamma$ -chlordane, endrin and p,p'-DDD were the only OCPs which showed significant difference ( $p < 0.05$ ) among the species.  $\beta$ -HCH and aldrin showed a significant difference in their concentrations among the different sampling locations. Concentration values of all OCPs were below the maximum allowable concentrations. The trace metals Cd, Cr, Cu, Fe, Mg, Mn, Pb and Zn were analysed using the Inductively Coupled Plasma- Atomic Emission Spectrometry (ICP-AES) method. Significantly higher levels of Mg were detected in all samples than other metals. Highest levels of Cd, Cr, Cu, Fe, Mg and Pb were found in *S. officinalis* (range: 3.60-242.92 ng/g dry wt.). *S. dorsalis* had the highest level of Zn (range: ND-1786.346 ng/g dry wt.) and *S. maderensis* recorded the highest concentration of Mn (range: 2.62-1062.43 ng/g dry wt.). The metals Cd, Cr, Mg, Mn and Zn showed a significant difference ( $p < 0.05$ ) among the species analysed. The mean concentrations of all trace metals fell below the WHO limits. Food consumption survey conducted in all seven landing sites revealed seafood consumption rate of about 52.22, 52.24 and 52.53 g person, 1 day<sup>-1</sup> for *S. maderensis*, *S. dorsalis* and *S. officinalis* respectively. Calculated hazard ratios revealed cancer risks associated with total PCBs,  $\gamma$ -HCH, endosulfan compounds, methoxychlor, heptachlor and dieldrin. There was however no cancer risks due to p,p'-DDT concentrations. Calculated Target Hazard Quotients (THQs) of Cd, Cr, Cu, Fe, Mn, Pb and Zn showed that, there are not ample concentrations yet in the environment to cause cancer. About 84% of respondents

were not aware of any possible chemical contamination of sea foods. Bioaccumulation in the fish tissues is however taking place speedily. Therefore, Continual monitoring of PCBs, OCPs and trace metals in various environmental compartments (such as sediment and fish) is urgently needed to moderate effectively their impact on human health and the ecological environment. The microbial quality analysis of fresh samples of the seafoods revealed counts of *E. coli* (range:  $ND^{4.6}$  log cfu/g) and total coliform (range: NO-5.3 log cfu/g) that are of great concern to human health. Aerobic mesophilic count (range: NO-7.6 log cfu/g) also revealed disturbing levels. *Salmonella sp* and *Cl. perfringens* were however absent in all samples. The *Vibrio sp.* detected in the fresh seafood samples were of both the gram-positive and gram-negative strains, Analysis of microorganisms was carried out using the Nordic Committee on Food Analysis (1985) protocol. The post - rigor pH range of sea foods were between 5.64 and 6.59.

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