BIOCONCENTRATION OF MERCURY BY OYSTER MUSHROOM (*Pleurotus ostreatus*) FROM SOUTHERN NIGERIA

Innocent Chidi Nnorom[1], **J. Falandysz**[2]

[1]*Abia State University, Department of Chemistry, Uturu, Nigeria*
[2]*University of Gdańsk, Laboratory of Environmental Chemistry & Ecotoxicology, Gdańsk, Poland*
chidiabsu@yahoo.co.uk

Keywords: mushroom; Nigeria; mercury; contamination; forest food

Introduction

Many edible mushrooms are valued in gourmet tradition as tasty, nutritious and healthy organic foods around the world (Falandysz et al., 2011; Nnorom et al., 2013). Mercury contamination of foodstuff is of interest because of the toxicity of Hg. Mercury is well bio-concentrated by some mushrooms, and studies have shown that Hg occurs in some mushrooms at much greater concentrations compared to those found in plants (Brzostowski et al. 2011). Exposure to Hg can have both acute and chronic health risks. The surveillance of Hg contamination of foodstuff including mushrooms lacking such data is therefore advisable. The aim of the present study was to investigate the potential of Oyster mushroom (*Pleurotus ostreatus*) to accumulate Hg and to define concentration profiles of Hg in caps and stipes of the mushroom fruiting bodies.

Methods

Fruiting bodies of *Pleurotus ostreatus* and the underlying substrate beneath the mushroom were collected forested areas in three distant sites in Abia State, Nigeria. The materials were collected from Ubakala, Ekeoba, and Ntigha. The dried mushroom parts (caps and stipes) were pulverized in a porcelain mortar and preserved in sealed polyethylene bags prior to analysis. The total mercury content were determined separately in caps and stipes; and in the substrate by cold-vapor atomic absorption spectroscopy (CV–AAS) using Mercury analyzer type MA–2000 (Nippon Instruments Corporation, Takatsuki, Japan). Adequate quality assurance and quality control (QA/QC) were included (Jarzynska and Falandysz, 2011)

Results

Mercury concentrations in underlying soil were 18±5.2, 19±8.4, and 16±4.3 ng g^{-1} in samples from Ekeoba, Ntigha, Ubakala, respectively. The mean Hg concentrations in caps are 31±11, 28±7.9, and 29±5.0 ng g^{-1} dw; and for stipes are 37±5.0, 36±17 and 28±5.6 ng g^{-1} dw for samples from Ekeoba, Ntigha, Ubakala, respectively. The geometric mean of cap to stipe concentration quotient ($Q_{c/s}$) values varied from 0.82-1.0 indicating that the Hg contents of the morphological parts of the fruiting bodies of *Pleurotus ostreatus* did not vary significantly. The BCF (bioconcentration factor) is the quotient of Hg in mushroom fruiting bodies (caps and stipes) to Hg in substrate as shown in **Table 1**. Higher BCF indicates accumulation of Hg contents of the soils by the mushroom. The caps and stipes were characterized by mean BCF values ~2 indicating

that *Pleurotus ostreatus* is a very weak mercury accumulator. The Hg contents did not exceed the maximum levels set by the EU for mushrooms.

Table 1. Mercury content of caps and stipes of *Pleurotus ostreatus* and the substrate (ng g^{-1} dry weight; mean±SD, range, and geometric mean) from three sites in Abia State Nigeria, and their bioconcentration for caps (BCF_C) and stipes (BCF_S); and the cap to stipe concentration quotient (QC/S) values

Element	Cap	Stipe	Soil	BCF_C	BCF_S	$Q_{C/S}$
Ekeoba	31±11 21-58 30	37±5.0 28-44 36.	18±5.2 12-26 18	1.9±1.0 0.86-4.5 1.7	2.2±0.75 1.4-3.2 2.1	0.87±0.38 0.50-1.8 0.82
Ntigha	28±7.9 18-39 27	36±17 21-83 33	19±8.4 8.8-38 18	1.6±0.65 0.90-2.7 1.5	2.1±1.2 0.88-4.6 1.9	0.88±0.39 0.47-1.8 0.82
Ubakala	29±5.0 21-35 28	28±5.6 21-37 28	16±4.3 11-25 16	1.9±0.57 0.91-2.9 1.8	1.8±0.45 1.3-2.6 1.8	1.1±0.33 0.64-1.6 1.0

Conclusion

This study have shown that the total Hg concentration in caps of *Pleurotus ostreatus* did not vary much from the corresponding values for the stipes. The mean BCF of all examined caps and stipes were greater than 1 (range 1.6 - 2.2), so *Pleurotus ostreatus* can be characterized as weak Hg accumulator. Compared to the established limits for Hg intake from foods (PTWI and RfD limits), the occasional or relatively frequent eating of meals made of both the caps and stipes of *Pleurotus ostreatus* is considered safe.

References

Brzostowski A, Falandysz J, Jarzyńska G, Zhang D (2011) Bioconcentration potential of metallic elements by Poison Pax (*Paxillus involutus*) mushroom. *J of Environ Sci and Health, Part A*., 46 (4), 378-393.

Falandysz, J.; Frankowska, A.; Jarzyńska, G.; Dryżałowska, A.; Kojta, A.K.; Zhang, D. (2011). Survey on composition and bioconcentration potential of 12 metallic elements in King Bolete (*Boletus edulis*) mushroom that emerged at 11 spatially distant sites. *J Environ Sci and Health, Part B.,* 46 (3), 231-246.

Jarzynska, G., Falandysz, J. (2011). The determination of mercury in mushrooms by CV-AAS and ICP-AES techniques. *J. Environ. Sci. Health Part A Tox. Hazard. Subst. Environ. Eng*., 46, 569–573.

Nnorom, I.C., Jarzyńska, G., Drewnowska, M., Dryżałowska, A., Kojta, A., Pankavec, S., Falandysz, J. (2013) Major and trace elements in sclerotium of *Pleurotus tuber-regium* (Ósū) mushroom - dietary intake and risk in Southeastern Nigeria. *J. Food Comp Anal.,* 29, 73-81.