MERCURY IN UNPROCESSED AND HOUSEHOLD PROCESSED MUSHROOMS

Jerzy Falandysz, Marlgorzata Drewnowska

University of Gdańsk, Laboratory of Environmental Chemistry & Ecotoxicology, Gdańsk, Poland
jerzy.falandysz@ug.edu.pl

Keywords: Cooking; fungi; mercury; mushrooms

Introduction

Mushrooms foraged from the wild are traditional and popular organic food, which is considered rich in macro- and microelements but accessibility to good foraging areas, gourmet receipts and tradition, and intake *per capita* of foraged mushrooms highly vary in the regions of the world (Falandysz and Borovička, 2013; Kalač 2016).

Mercury (Hg) is a priority global pollutant and is one of the metallic elements undesired in food, which is well accumulated in the fruiting bodies by various species of mushrooms. Mercury, both from a fallout (largely arising from the anthropogenic emissions) and from the natural geogenic sources e.g. in the Circum-Pacific Mercuriferous Belt regions, can matter as a contaminant in the edible mushrooms (Falandysz, 2016; Falandysz et al., 2014 and 2015).

Mushrooms can be treated in different manner, and the cooking books gave many receipts. Cooking can have a pronounced impact on content and composition of compounds in a mushroom (Biekman et al. 1996). Some of the treatments are of more general or universal nature, e.g. a short time (5-15 min) boiling (blanching) or boiling for a longer time, while other can be specific for a species of mushroom or a dish. Blanching is a highly radical manner, because of high excess of boiling water used and what cause a fruit body dehydration and shrinkage, and denaturation, hydrolysis and a partial dissolution of the organic and inorganic constituents of mushroom.

Aim of this study was to investigate the potential of blanching in removal of mercury from the mushrooms such as *Cantharellus cibarius* and *Amanita fulva*.

Methods

A whole fruiting bodies of *Cantharellus cibarius* and caps of *Amanita fulva* were used. Mushrooms were collected from the background (unpolluted) areas from the northern regions of Poland. Mushrooms were respectively dried conventionally, deep-frozen, freeze-dried, blanched and pickled using a commercial vinegar based marinade.

Mercury was determined using cold-vapour atomic absorption spectroscopy (CV-AAS) by a direct sampled material thermal decomposition coupled with gold wool trap of mercury vapors and its further desorption and quantitative measurement at wavelength of 253.7 nm. The analytical instrument used was mercury analyzer equipped with auto sampler and operated respectively at low and high mode (Jarzyńska and Falandysz, 2011).

Analytical control and assurance quality (AC/AQ) were assessed through analysis of blank samples and two certified fungal reference materials: CS-M-2 and CS-M-4 both produced by the Institute of Nuclear Chemistry and Technology, Warsaw, Poland.. Our results agreed well with the certified values.

Results

Fresh *C. cibarius* blanched for 5 or 15 min in potable or deionized water lost Hg by 12±7 to 13±5% on the average. A deep-frozen *C. cibarius* when blanched lost Hg by 33±6 to 36±6% on the average. Fresh caps of *A. fulva* blanching lost Hg by 56±2%.

Pickling had only a minor effect or was without effect on leaching of Hg from the blanched mushrooms. Total leaching rate of Hg for *C. cibarius* was between 15±t to 21±6% when treated (blanched and pickled) were fresh mushrooms and between 37±7 to 39±8% when treated were a deep frozen mushrooms. For blanched or blanched and pickled caps of *A. fulva* drop of Hg was between 50±3 to 56±2%.

Conclusion

Mercury is better extracted by boiling water from *A. fulva* than *C. cibarius*. Blanching of a fresh and sliced *C. cibarius* causes leakage of Hg by around 15%, while blanching of a deep frozen and sliced *C. cibarius* by around 35%. The rate of Hg leaching from the *C. cibarius* in practice was the same when blanched for 5 or 15 min. Blanching of *A. fulva* causes loss of Hg by around 56%. Pickling had only little impact if any on leaching of Hg from the blanched *C. cibarius* or *A. fulva*.

Funding

This study in part was financially supported to by the National Science Centre of Poland under call PRELUDIUM (Project no DEC-2012/05/N/NZ9/01561).

References

Biekman, E.S.A., Kroese-Hoedeman, H.I., Schijven, H.P.H.M. (1996). Loss of solutes during blanching of mushrooms (Agaricus bisporus) as a result of shrinkage and extraction. J. Food Eng., *28*, 139-152.

Falandysz, J. (2016). Mercury bio-extraction by fungus *Coprinus comatus*: a possible bioindicator and mycoremediator of polluted soils. Environ. Sci. Poll. Res., 2016, 23, 7444-7451.

Falandysz, J., Borovička, J. (2013). Macro and trace mineral constituents and radionuclides in mushrooms: health benefits and risks. Appl. Microbiol. Biotechnol., 97, 477-501.

Falandysz, J., Dryżałowska, A., Saba, M., Wang, J., Zhang, D. (2014). Mercury in the fairy-ring of *Gymnopus erythropus* (Pers.) and *Marasmius dryophilus* (Bull.) P. Karst. mushrooms from the Gongga Mountain, Eastern Tibetan Plateau. Ecotox. Environ. Saf., *104*, 18-22.

Falandysz, J., Zhang, J., Wang, Y., Saba, M., Krasińska, G., Wiejak, A., Li, T. (2015). Evaluation of the mercury contamination in Fungi Boletus species from latosols, lateritic red earths, and red and yellow earths in the Circum-Pacific Mercuriferous Belt of Southwestern China. PLoSONE, *10*, e0143608.doi:10.1371/journal.pone.0143608.

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

Kalač, P. Edible mushrooms, chemical composition and nutritional value. Academic Press, London, 2016.