



“Gheorghe Asachi” Technical University of Iasi, Romania



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HORMONAL ACTIVITIES OF NOVEL BROMINATED FLAME RETARDANTS AND THEIR BIODEGRADATION BY WHITE ROT FUNGI

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Abstract

Over the last years, a number of articles focused on brominated flame retardants (BFR) as new pollutants in the environment. These compounds have been used in high volumes to reduce the flammability of numerous types of polymers and resins commonly found in furniture and electronic components. Some of these flame retardants (octabromodiphenyl ether and pentabromodiphenyl ether) were proved to be toxic and persistent in the environment. Nowadays these substances are also listed as POPs by Stockholm convention. After the phase out of previously used BFR, many new and alternative BFR have been used for commercial applications. However, the knowledge about these new substances and their fate in the environment is limited. In the recent years, several articles have demonstrated that some of these compounds are detected in environmental samples. The compounds have been found to have long transport potential and to be toxic. This article focuses on biodegradation ability of white rot fungi toward these new pollutants. *Trametes Versicolor*, *Bjerkandera Adusta*, *Irpex lacteus*, *Pleurotus ostreatus*, *Phanerochaete chrysosporium*, *Dichomitus squalens*, *Setulipes androsaceus* and litter decomposing strain PL13 from CCBAS Institute of Microbiology ASCR have been used in this study. Each fungi grew in malt extract - glucose medium that had been artificially contaminated with a mixture of brominated flame retardants: 1,2-bis(2,4,6-tribromophenoxy)ethane (BTBPE), bis(2-ethylhexyl) tetrabromophthalate (BTBP), 2,3,4,5,6-pentabromoethylbenzene (PBEB), 2,3,4,5,6-pentabromotoluene (PBT), 2,4,6-tribromophenol (TBP), hexabromobenzene (HBB), 2-allyloxy-1,3,5-tribromobenzene (ATBB), pentabromobenzyl acrylate (PBBA) and decabromobiphenyl (DBB). The fungi were incubated for 7 and 22 days. Afterward, gas chromatography with mass spectrometry was employed to determine concentrations of the tested compounds in the medium. The degradation result from the experiment showed that only three compounds (TBP, ATBB, PBBA) were degraded by the fungi. Flame retardants such as BTBPE, BTBP, HBB or DBB did not exhibit any significant removal. We also used two bioassays with recombinant strain *Saccharomyces cerevisiae* to investigate hormonal activities of these new BFR. Our data demonstrate the ability of 2,4,6-tribromophenol to lower the transcriptional activity of human estrogen and androgen receptor. PBBA and BTBPE also show slightly antihormonal effects. Our findings suggest that persistency of the new BFR being possibly a serious problem. Results also show that TBP could be classified as a new environmental endocrine disruptors. These results emphasize the need for a further research in biodegradability and hormonal activity of brominated flame retardants.
