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Changes in chemical composition of humic substances during microbial composting and Agaricus bisporus mycelial growth

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The substrate production process for the edible mushroom Agaricus bisporus can serve as a model environment to investigate organic matter transformation by microbes. Until now, insights in chemical compositional changes of humic substance (HS) throughout the substrate production process are scarce, and their nutritional properties for the fungus are unknown. To reveal these compositional changes, dissolved and solid HS were extracted with water and acid/base, respectively, from bulk material harvested throughout the microbial composting and mycelial colonization of A. bisporus. Total carbon and nitrogen were analyzed in bulk material and corresponding HS fractions, while bulk material was also analyzed for carbohydrates, fatty acids, and lignin content and composition. Isolated humic acids (HA), fulvic acids (FA), and bulk material were further analyzed by pyrolysis-GC-MS. Throughout microbial composting HS increased substantially, with HA as main fraction followed by FA. The HS increase was accompanied by a high lignocellulose decrease and enrichment of organic nitrogen, as shown by analysis of bulk material and concurrent HA and FA isolates. HA was particularly rich in lignin(-like) and nitrogen compounds. At the early stage of A. bisporus colonization, HS, and particularly HA, decreased, which suggests the importance of HA as fungal carbon and nitrogen nutrient source.