

Use of Edible and Medicinal Mushrooms Spent Compost in Remediation of Polluted Soils

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Spent mushroom substrate represents a serious environmental problem owing to its bulk volume as a waste material. From the time industrial mushroom production was at an early stage interest has existed in gaining a profit not only from collected mushrooms but also by using spent mushroom substrate. Spent compost of *Agaricus bisporus* (J. Lge) Imbach has been used as a garden soil fertilizer and a conditioner, but on a local scale only. *Pleurotus ostreatus* (Jacq.: Fr.) Kumm. spent straw substrate was used as an addition to cattle fodder, but only to a limited extent because of technical and hygienic complications.

In the mid-1980s it was demonstrated that some ligninolytic basidiomycetes were able to degrade recalcitrant environmental pollutants [e.g., polyaromatic hydrocarbons (PAHs), chlorophenols, DDT, synthetic dyes, polychlorinated biphenyls, and dioxins]. This was the start of the effort to apply these mushrooms for remediation of soil contaminated with hazardous organic compounds. In the beginning, *Phanerochaete chrysosporium* Burds. was the most studied mushroom, but soon other species were evaluated for their potential to degrade organopollutants, including edible mushrooms such as *Pleurotus ostreatus* (oyster mushroom) and *Lentinus edodes* (Berk.) Sing. (shiitake).

Edible mushroom production is a large industry in several countries, and there is a huge amount of residual substrate (approx 5 kg per

kilogram of mushroom). The spent mushroom substrate, which still contains an active mushroom mycelium, is an agroindustrial byproduct and available nearly for free. Application of white rot fungi for bioremediation has a practical aspect—the availability of mushroom substrate.

Pleurotus ostreatus, both in freshly colonized straw and spent substrate from commercial oyster mushroom production, has demonstrated high efficiency for PAH degradation in nonsterile soil; 86% reduction of 16 US.EPA PAHs, 89% of three-ring PAHs, 87% of four-ring PAHs, and 48% of five-ring PAHs within 7 weeks of incubation. Spent oyster mushroom substrate was also shown to degrade the resistant pesticide DDT in soil. After 4 weeks of incubation the initial concentration of 573 mg DDT/kg of soil decreased to 356 mg. Similarly, spent sawdust culture of *Lentinus edodes* showed 60% reduction of phenachlorophenol in contaminated soil.

The production facilities in a commercial mushroom farm could also be used for production of lignocellulosic material colonized with other mushroom strains that possess high biodegrading potential. This article presents the procedure of selection of fungal strains with high capability for xenobiotic degradation. In addition, results from PAH degradation in aged contaminated soil using spent fungal substrate (*Pleurotus ostreatus*) are included.