Preface

Advances in Macrofungal Biotechnology

Mushroom-forming fungi have a long history of use, not only as foods, but also as medicines for a wide range of ailments. Over the centuries, and especially in the last decades, domestication of wild species and development of appropriate cultivation techniques have supplied the world market with more and more new species. The current state-of-the-art with respect to the production of fruiting bodies of a range of mushrooms is well described in many papers and books. However, there is also a growing market for mushroom products other than fruiting bodies. This special issue focuses on the production and application of such products from selected mushroom-forming basidiomycetes.

For these products typically, although not always, the cultivation system involves submerged culture in bioreactors for the production of mycelial biomass and specific metabolites, or for the realisation of specific activities related to their wood-degrading abilities. Despite the fact that several polysaccharides from mushrooms are produced commercially in submerged fermentation, there are still many gaps in our knowledge about how to grow basidiomycetes in bioreactors, as pointed out in the review by Tang *et al.* (*1*).

This special issue contains six other reviews about biotechnological applications of several important genera or groups of macrofungi. One of the first basidiomycetes that was cultivated in submerged culture at large scale was the shiitake fungus, *Lentinula edodes*. Nikitina *et al.* (*2*) show how the focus of research with this fungus has shifted from the production of polysaccharides, such as lentinan, to other products, such as lectins. Another important macrofungus is the oyster mushroom, *Pleurotus* spp. The review of Gregori *et al.* (*3*) shows how new substrates, including agricultural residues and by-products, have been used for production of fruiting bodies of this genus. It also shows how enzymes have been produced in solid-state fermentations on lignocellulosic waste materials. In submerged culture, *Pleurotus* spp. have been used to produce polysaccharides and hydrolytic and oxidative ligninolytic extracellular enzymes.

Two reviews are intimately related with the ability of some basidiomycetes to degrade wood. Nyanhongo *et al.* (*4*) review the production, by white-rot basidiomycetes of the genus *Trametes*, of the enzyme laccase, cellobiose dehydrogenase, and pyranose 2-oxidase, three enzymes that participate in lignin breakdown and which have either demonstrated or potential biotechnological applications. On the other hand, Fackler *et al.* (*5*) review work on selective lignin conversion by various white-rot fungi, showing how this selective conversion can be taken advantage of in the modification of wood surfaces, which, in turn, can be taken advantage of in wood-gluing processes.

Two other reviews address quite different topics. Rossi *et al.* (*6*) review techniques for the production of ectomycorrhizal fungal inoculants for use in forestry. This application is likely to become increasingly important with the increasing need for tree replanting in order to supply the worldwide demand for wood without destroying more native forests. Finally, de Faria *et al.* (*7*) show how tyrosinases from basidiomycetes have several potential biotechnological applications, but that much more attention needs to be given to processes for the production, purification and immobilization of these enzymes.

The special issue also includes four original research papers that deal with the production of polysaccharides in submerged culture of various basidiomycetes and investigation of their biological activities. Kim *et al.* (*8*) describe the production of extracellular polysaccharide in submerged culture by *Grifola frondosa* and demonstrate that it has potential as a biologically active cosmetic ingredient, or »cosmeceutical«. Hwang *et al.* (*9*) show that the extracellular polysaccharide of *Phellinus baumii* has an antidiabetic effect, while Shin *et al.* (*10*) demonstrate an anti-complementary activity for the exopolysaccharide of *Flammulina velutipes.* Finally, Shu *et al.* (*11*) optimize the production of exopolysaccharide by *Agaricus brasiliensis*, this exopolysaccharide being able to stimulate the production of tumor necrosis factor-alpha (TNF-α) by macrophages. A final paper deals with the characterization of the tyrosinase produced in submerged culture by *Lentinula boryana*. De Faria *et al.* (*12*) show that this tyrosinase suffers from substrate inhibition in its reaction with L-DOPA.

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