

## Submerged Culture Conditions for the Production of Exo- and Endo-Polysaccharides by *Ganoderma applanatum* (Pers.) Pat.

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*Ganoderma applanatum* is a perennial mushroom (Basidiomycetes) which causes white rot in broad-leaved trees. The fruit body has been used as a traditional anticancer medicine in China and is reported to have various beneficial physiological activities such as antitumor, antiviral, and immunostimulating activities. These biological activities are known to be associated with polysaccharides, and protein-bound polysaccharides were isolated from the fruiting bodies and mycelium.

Submerged cultures of edible fungi obviously have the potential for higher mycelial production or for inducing mass production of useful substances in compact space in a short time period with easy environmental control. The aim of this investigation was to determine the optimal polysaccharide production conditions from *G. applanatum* in submerged culture. In order to produce the immunostimulating water-soluble polysaccharides from the mycelium, the effects of several cultivating factors on polysaccharide production were studied. We were especially interested in the factors affecting the re-

lationship between exo- and endo-polysaccharide production.

Carbon sources, carbon concentrations, culture temperature, and culture period influenced mostly the production of polysaccharides. The effective carbon sources for polysaccharide production were maltose, lactose, and glucose. High yield of the exopolysaccharide required higher temperatures (25 °C), higher carbon concentrations (60 g/L), and shorter culture periods (8–12 days). In contrast, endopolysaccharide production required lower culture temperatures (10–15 °C), lower levels of carbon (20 g/L), and a minimum of a 10-day culture period. *G. applanatum* accumulated endopolysaccharides in their bodies at lower temperature conditions. Meanwhile, more exopolysaccharides were produced at moderate temperatures and in the stationary growth phases. Under optimal culture conditions, the yield of water-soluble endopolysaccharides and exopolysaccharides reached 4 g/L and 2 g/L, respectively. The sugar compositions and chemical characteristics of the polysaccharides were also studied.