

## ABSTRACT

### Role of Trehalose in the post-harvest metabolism of *Pleurotus* spp. mushrooms

*Audia Zeane Barnett*

Investigations were carried out on locally cultivated *Pleurotus* sp. mushrooms to ascertain the role of trehalose metabolism during post-harvest storage. Trehalose, known as a stress protectant and energy reservoir, has recently been found to confer stability on biological molecules undergoing anhydrobiosis and cryptobiosis. Its value in the pharmaceutical, food and related industries has been explored with remarkable success (Roser, 1991a,b).

Baseline studies on the composition of the *Pleurotus* sp. mushroom indicated fairly high levels of trehalose relative to that found in the common Button (*Agaricus* sp.) Mushroom. Trehalase, the enzyme responsible for metabolizing trehalose, was found to be the acidic type, and bound to the cell wall. During controlled post-harvest storage of *Pleurotus* sp. sporophores, several noteworthy discoveries were unveiled.

Trehalase levels in the *Pleurotus* sp. were some thirty seven times that found in *Agaricus* sp., attributable to genetic differences and large morphological anomalies between the two mushrooms. Trehalose levels were found to fluctuate during post-harvest storage, suggesting its metabolism during the rapid developmental changes and heavy spore shedding activities involved. These factors together with the higher trehalose levels in the *Pleurotus* sp. suggest that

trehalose/trehalase metabolism may play a significant role in post-harvest metabolism of *Pleurotus* spp. Apparent physical separation of the trehalase enzyme from its substrate trehalose resulted in a lag period between increased trehalase activity and the reduction of trehalose levels in the fruiting bodies. In addition, there appeared to be a metabolic balance between trehalose and trehalase in the mushroom.

Changes in trehalase activity during storage of the sporophores were highly dependent on the relative time of harvesting. An important practical application arising from these findings presents an alternative to the current practice of harvesting these mushrooms. It is therefore suggested that harvesting should take place before the actual formation of mature fruiting bodies, i.e. when the trehalase activity is low and is likely to decrease further during post-harvest storage.

Inhibition of trehalase by chemical and physical means was achieved at the mycelial level.

Validamycin-A was able to significantly reduce trehalase activity at a rate of  $1.5 \mu\text{g mL}^{-1}$ , while a temperature of  $37^\circ\text{C}$  was also shown to be effective.

With the aid of the Polymerase Chain Reaction (PCR), a putative fragment was isolated as the trehalase gene. Fragments obtained from Rapid Amplification of Polymorphic DNA may serve a useful role in screening *Pleurotus* spp. mushrooms with optimal trehalase profiles.

Furthermore, this work has set the stage for conducting additional studies on controlling trehalose levels through manipulation at the genetic level.