A scanning electron microscopy study of the growth and attack on wood by three white-rot fungi and their cellulase-less mutants.

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Karl-Erik Eriksson / Annette Grünewald / Thomas Nilsson / Lars Vallander

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A Scanning Electron Microscopy Study of the Growth and Attack on Wood by Three White-Rot Fungi and Their Cellulase-less Mutants

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A Scanning Electron Microscopy Study of the Growth and Attack on Wood by Three White-Rot Fungi and their Cellulase-less Mutants

Summary

White-rot fungi, which have the ability to degrade all the wood components including lignin, are of great interest in biotechnological processes based on wood and other ligno-cellulosic materials. It was earlier demonstrated that enough lignin can be degraded to cause a decrease in the energy demand for the production of mechanical pulp if wood chips are pretreated by cellulase-less mutants of white-rot fungi.

In view of these facts it has been important to study the growth pattern in wood of the wild-type (WT) white-rot fungi and their cellulase-less mutants. In this paper, the growth patterns of WT fungi and mutants, and the micro-morphological changes in wood emanating from attack by these different organisms, have been investigated by the aid of scanning electron microscopy (SEM). The results show that, although differences exist between WT fungi and mutants, the similarities are more striking. Probably the main difference between WT fungi and mutants is that the WT organisms can cause thinning of the wood cell walls whereas the mutants are unable to do so. It should also be pointed out that WT *Sporotrichum pulverulentum* causes bore holes in the wood fibre cell walls while its cellulase-less mutant, Cel 44, does not.

Schlüsselwörter (Sachgebiete)
Biologischer Abbau
Mikroskopie
REM
Weißfäulepilze
Cellulasefreie Mutanten

Untersuchungen über Wachstum und Holzangriff von drei Weißfäulepilzen und deren cellulasefreien Mutanten mit Hilfe der Raster-Elektronenmikroskopie

Zusammenfassung

Weißfäulepilze, die die Fähigkeit besitzen, alle Holzbestandteile einschließlich Lignin abzubauen, sind für biotechnologische Prozesse, die sich auf Holz oder andere ligno-cellulosische Materialien beziehen, von großem Interesse. Es konnte in vorausgegangenen Arbeiten gezeigt werden, daß soviel Lignin abgebaut werden kann, daß der Energiebedarf bei der Holzstofferzeugung sinkt, wenn die Hackschnitzel mit cellulasefreien Mutanten des Weißfäulepilzes vorbehandelt werden.

Im Hinblick auf diese Tatsachen erschien es wichtig zu sein, die Wachstumsmuster der Wildtype (WT) des Weißfäulepilzes und deren cellulasefreien Mutanten im Holz zu studieren. In vorliegender Arbeit werden die Wachstumsmuster des Weißfäulepilzes und der Mutanten sowie die mikromorphologischen Veränderungen im Holz, die von dem Angriff dieser verschiedenen Mikroorganismen herrühren, mit Hilfe der Rasterelektronenmikroskopie untersucht. Die Ergebnisse zeigen, daß, obgleich Unterschiede zwischen den WT-Pilzen und den Mutanten bestehen, die Ähnlichkeiten überwiegen. Offenbar ist der Hauptunterschied zwischen den WT-Pilzen und den Mutanten der, daß die WT-Organismen ein Dünnerwerden der Holzzellwände verursachen können, wozu die Mutanten nicht fähig sind. Es sei auch erwähnt, daß die WT von *Sporotrichum pulverulentum* Bohrlöcher in der Holzfaserzellwand hervorrufen kann, was die cellulasefreie Mutante, Cel 44, nicht zustande bringt.

Introduction

The white-rot fungi are the most efficient of wood rotting fungi. These organisms have in common the capability to degrade lignin and all other wood components (Ander and Eriksson 1978). The bioconversion of wood by micro-organisms is an important development to which more and more attention is being paid. From what has been said above it is obvious that white-rot fungi are particularly useful in this context. Even when an absolutely specific attack on the lignin is not achieved, it has been demonstrated (Ander and Eriksson 1975a) that enough lignin can be degraded to cause a decrease in the energy demand for production of mechanical pulp if the wood chips are pretreated by cellulase-less mutants of white-rot fungi. Low molecular weight sugars and some of the xylan in wood are used as co-substrates (Ander and Eriksson 1975b).

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