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Enhanced Cellulase Production by *Aspergillus fumigatus* Fresenius

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ABSTRACT

The compost isolate, *Aspergillus fumigatus*, produces the exoglucanase, endoglucanase, and β-glucosidase enzymes required for the breakdown of crystalline cellulose. Cellulose breakdown and extracellular enzyme levels in liquid culture can be affected by low pH values attained during fungal growth. During growth of *A. fumigatus* on modified Czapeck-Dox medium containing 1% (w/v) Avicel, it was found that β-glucosidase activity was lost and endoglucanase activity, reduced, when pH values fell below 3.

The effect of buffering (0.2*M* phosphate, pH 6.15) was examined and compared with the unbuffered medium. Beta-glucosidase activity could be detected throughout the incubation period in the buffered medium and endoglucanase activity was approximately tenfold greater. Exoglucanase activity also showed an increase in the buffered system.

Concentrations of phosphate buffer ranging from 0.05 to 0.8*M* were incorporated into the medium and optimum cellulose breakdown and extracellular enzyme production occurred between 0.1 and 0.2*M*.

Reports suggest that increasing substrate concentration does not improve upon the levels of extracellular cellulase produced because of enzyme inactivation resulting from rapid decreases in pH. Using the buffered medium described previously, *A. fumigatus* was grown on concentrations of Avicel ranging from 0.5 to 10% (w/v). Cellulose breakdown and extracellular enzyme production was compared with that achieved by a similar nonbuffered system. Endoglucanase and β-glucosidase activity increased with time and with substrate concentration up to 5% (w/v) in the buffered medium. Beta-glucosidase was negligible at all concentrations of Avicel in the unbuffered medium and endoglucanase activity decreased with increasing substrate concentration with maximum levels approximately eightfold lower than in the buffered system. Extracellular exoglucanase activity was lower in the buffered medium and only in-

creased to levels comparable with those achieved by the unbuffered medium towards the end of the incubation period. In the unbuffered system, exoglucanase activity decreased with increasing substrate concentration, but no such effect was observed in the buffered medium. Negligible growth occurred in both media at 10% (w/v) substrate.

The percentage weight loss recorded in the Czapeck-Dox medium also decreased with increasing substrate concentration, while in the buffered medium, over 95% weight loss was recorded in up to 5% (w/v) Avicel.

It appeared that cellulose breakdown was more rapid in the buffered medium and a time-course carried out to determine the rate of cellulolysis showed 97% cellulose breakdown after 12 d, corresponding to a plateau and a subsequent decrease in extracellular cellulase levels.