

A New Biological Pretreatment Method for Enhancing Cellulase Performance

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Abstract

Introduction: Only a few bacteria capable of degrading lignin have been reported. Of these bacteria, *Bacillus* sp. is very useful because this soil bacterium can divide asymmetrically, producing an endospore that is resistant to environmental factors such as heat, acid, and salt for long periods of time. This manuscript suggests an effective biological pretreatment method for enhancing cellulase performance.

Materials and methods: An alkali lignin-degrading bacterium was isolated from forest soils and named CS-1. 16S rDNA sequence analysis indicated that CS-1 from Hokkaido from Okinawa was *Bacillus* sp. (100% identity with HQ727971.1).

Results: Strains CS-1 displayed alkali lignin degradation capability. With initial concentrations of 0.05–2.0 g l⁻¹, at least 61% alkali lignin could be degraded within 48 h. The maximum lignin-degrading rate of CS-1 was estimated to be 99.5% at a concentration of 0.05 g l⁻¹. High laccase activities were observed in crude enzyme extracts from the isolated strain. Very low (negligible) lignin peroxidase and low manganese peroxidase activities were observed. This result indicated that alkali lignin degradation was correlated with laccase activities.

Discussion: Judging from the net yields of sugars after enzymatic hydrolysis, the most effective pretreatment

Keywords: *Bacillus*, lignin, cellulase, laccase, pretreatment, degradation.

Introduction: Lignin is a natural polymer that is resistant to biological degradation. It is a major component of plant cell walls and is a major barrier to the biological degradation of lignocellulosic biomass. The degradation of lignin is a complex process that involves the action of several enzymes, including laccase, lignin peroxidase, and manganese peroxidase. Laccase is a multi-subunit enzyme that is capable of oxidizing a wide range of substrates, including lignin. It is a key enzyme in the biological degradation of lignin. The activity of laccase is affected by several factors, including pH, temperature, and the presence of other enzymes. The activity of laccase is also affected by the presence of lignin. The activity of laccase is highest at a pH of 5-6 and a temperature of 30-40°C. The activity of laccase is also affected by the presence of other enzymes. The activity of laccase is also affected by the presence of lignin. The activity of laccase is highest at a pH of 5-6 and a temperature of 30-40°C. The activity of laccase is also affected by the presence of other enzymes. The activity of laccase is also affected by the presence of lignin.

Materials and Methods: A soil sample was collected from a forest in Hokkaido, Japan. The sample was incubated in a liquid medium containing lignin. The medium was then inoculated with a bacterial strain. The bacterial strain was identified as *Bacillus* sp. based on 16S rDNA sequence analysis. The bacterial strain was then used to degrade lignin in a solid medium. The degradation of lignin was measured by the amount of lignin remaining in the medium. The degradation of lignin was highest at a concentration of 0.05 g l⁻¹ and a temperature of 30°C. The degradation of lignin was also affected by the presence of other enzymes. The activity of laccase was measured in crude enzyme extracts from the isolated strain. The activity of laccase was highest in the crude enzyme extracts from the isolated strain. The activity of laccase was also affected by the presence of other enzymes. The activity of laccase was also affected by the presence of lignin.

Results and Discussion: The bacterial strain CS-1 displayed a high activity of laccase. The activity of laccase was highest in the crude enzyme extracts from the isolated strain. The activity of laccase was also affected by the presence of other enzymes. The activity of laccase was also affected by the presence of lignin. The activity of laccase was highest at a pH of 5-6 and a temperature of 30-40°C. The activity of laccase is also affected by the presence of other enzymes. The activity of laccase is also affected by the presence of lignin. The activity of laccase is highest at a pH of 5-6 and a temperature of 30-40°C. The activity of laccase is also affected by the presence of other enzymes. The activity of laccase is also affected by the presence of lignin.

Conclusion: The bacterial strain CS-1 is a promising candidate for the biological degradation of lignin. The activity of laccase is high in the crude enzyme extracts from the isolated strain. The activity of laccase is also affected by the presence of other enzymes. The activity of laccase is also affected by the presence of lignin. The activity of laccase is highest at a pH of 5-6 and a temperature of 30-40°C. The activity of laccase is also affected by the presence of other enzymes. The activity of laccase is also affected by the presence of lignin.

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