

## Cloning and Sequence Analysis of the Cellulase Genes Isolated from Two Cellulolytic Streptomyces and Their Heterologous Expression in *Streptomyces lividans*

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Cellulosic biomass, such as wood waste and rice straw, remains unexploited despite the high content of cellulose. Streptomyces are producers of industrially important antibiotics and most of the antibiotic-producing strains are unable to utilize cellulose. We have, therefore, aimed to breed streptomyces that produce antibiotics from cellulosic biomass. Two cellulolytic streptomyces, i.e. *Streptomyces thermocarboxydus* C42 and *Streptomyces argenteolus* M178, were selected on the basis of carboxymethyl cellulose (CMC)-degrading activity from approximately 1,000 soil-isolated streptomyces. Shotgun cloning experiments of cellulase genes from these genomic DNAs were performed in *Streptomyces lividans* as a host to find putative four cellulase genes, i.e. *cel9A<sub>C</sub>* and *cel5A<sub>C</sub>* from the C42 strain and *cel5A<sub>M</sub>* and *cel12B<sub>M</sub>* from the M178 strain. The transformants of *S. lividans* harboring the four genes subcloned in an expression plasmid showed secreted CMC-degrading cellulase (CMCase) activities, thus demonstrating successful cloning and heterologous expression of the cellulase genes from the cellulolytic streptomyces.

**Key Words** : cellulase, streptomyces, cellulosic biomass