PP-4

The potential of genetic modification in enhancing cellulase production by fungal species

Varuna Jayasinghe[1],Sandhya Jayasekara[1],Renuka Ratnayake[1]

[1]*Bioenergy and Soil Ecosystems Research Group, National Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka*

[*]***varuna2560@gmail.com***

Shortage of fossil fuels and their detrimental environmental impacts have resulted in a need for a renewable source of energy. Celluloses, the major components of plant biomass, can be converted into sugars and fermented to produce bioethanol, which has shown potential as a sustainable alternative. Many micro-organisms, particularly fungi, have the ability to convert cellulose into sugars using cellulase enzymes. However, they lack the efficiency to produce cellulases in amounts necessary for economically feasible bioethanol production. Thus, genetic modification has been explored as a means to solve this problem. This study reviews genetic modification techniques that have successfully enhanced fungal cellulase production in comparison with isolated wild type fungi. The reviewed studies used a range of techniques to modify the genetic structure of selected fungal species, and measured total cellulase activity (FPase) by Filter Paper Assay. In one study, *Aspergillus niger* strains were exposed to different doses of γ-rays of Co^{60}, with survivors exposed to sequential UV irradiation. Another study incorporated *Agrobacterium*-mediated transformation to modify *Trichoderma reesei* with an amplified beta-glucosidase I gene of *Penicillium decumbens*. Constitutional overexpression of *clrB* gene in *Penicilium oxalicum* was also done, coupled with the deletion of *creA*, a gene which represses the expression of cellulase genes. FPase of the modified *Aspergillus*, *Trichoderma* and *Penicillium* strains were recorded as 11.05 U/mL, 9.87 U/mL and 6.94 U/mL respectively, while the isolated species from the present study showed FPases of 0.464 U/mL, 0.574 U/mL and 0.438 U/mL respectively. The modified strains have thus shown up to a 20-fold increase in cellulase production compared to their respective wild types. This shows the potential of genetic modification in creating efficient fungal strains for feasible large-scale bioethanol production. The application of such techniques would be valuable for the present study as well.

Keywords: *Aspergillus*, Cellulase, Fungi, Genetic modification, *Penicillium*, *Trichoderma*