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Design of a Recombinant Expression System for Bacterial Cellulose Production

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Abstract : Cellulose is the most abundant biopolymer on earth and it is currently being utilised in a multitude of industrial applications. Over the last 30 years, attention has been paid to the bacterial cellulose (BC), since BC exhibits unique physical, chemical and mechanical properties when compared to plant-based cellulose, including high purity and biocompatibility. Although Acetobacter xylinum is the most efficient producer of BC, it’s long doubling time results in insufficient yields of the cellulose production. This limits widespread and continued use of BC. In this study, E. coli BL21 (DE3) or E. coli HMS cells are selected as host organisms for the expression of bacterial cellulose synthase operon (bcs) of A.xylinum. The expression system is created based on pET-Duet1 and pCDF plasmid vectors, which carry bcs operon. The results showed that all bcs genes were successfully transferred and expressed in E.coli strains. The expressions of bcs proteins were shown by SDS and Native page analyses. The functionality of the bcs operon was proved by congo red binding assay. The effect of culturing temperature and the inducer concentration (IPTG) on cell growth and plasmid stability were monitored. The percentage of plasmid harboring cells induced with 0.025 mM IPTG was obtained as 85% at 22˚C in the end of 10-hr culturing period. It was confirmed that the high output cellulose production machinery of A.xylinum can be transferred into other organisms.

Keywords : bacterial cellulose, biopolymer, recombinant expression system, production
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