The workability of Escherichia coli BL21 (DE3) and Pseudomonas putida KT2440 expression platforms with autodisplayed cellulases: a comparison

ABSTRACT

This article comparatively reports the workability of Escherichia coli BL21(DE3) and Pseudomonas putida KT2440 cell factories for the expression of three model autodisplayed cellulases (i.e., endoglucanase, BsCel5A; exoglucanase, CelK; β-glucosidase, BglA). The differentiation of the recombinant cells was restricted to their cell growth and enzyme expression/activity attributes. Comparatively, the recombinant E. coli showed higher cell growth rates but lower enzyme activities than the recombinant P. putida. However, the endo-, exoglucanase, and β-glucosidase on the surfaces of both cell factories showed activity over a broad range of pH (4-10) and temperature (30-100 °C). The pH and temperature optima were pH 6, 60 °C (BsCel5A); pH 6, 60-70 °C (CelK); and pH 6, 50 °C (BglA). Overall, the P. putida cell factory with autodisplayed enzymes demonstrated higher bioactivity and remarkable biochemical characteristics and thus was chosen for the saccharification of filter paper. A volumetric blend of the three cellulases with P. putida as the host yielded a ratio of 1:1:1.5 of endoglucanase, exoglucanase, and β-glucosidase, respectively, as the optimum blend composition for filter paper degradation. At an optical density (578 nm) of 50, the blend generated a maximum sugar yield of about 0.7 mg/ml (~ 0.08 U/g) from Whatman filter paper (Ø 6 mm, ~ 2.5 mg) within 24 h.