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Production and Characterization of a Novel Yeast Extracellular Invertase Activity Towards Improved Dibenzothiophene Biodesulfurization

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Abstract The main goal of this work was the production and characterization of a novel invertase activity from *Zygosaccharomyces bailii* strain Talf1 for further application to biodesulfurization (BDS) in order to expand the exploitable alternative carbon sources to renewable sucrose-rich feedstock. The maximum invertase activity (163 U ml^{-1}) was achieved after 7 days of *Z. bailii* strain Talf1 cultivation at pH 5.5–6.0, 25 °C, and 150 rpm in Yeast Malt Broth with 25 % Jerusalem artichoke pulp as inducer substrate. The optimum pH and temperature for the crude enzyme activity were 5.5 and 50 °C, respectively, and moreover, high stability was observed at 30 °C for pH 5.5–6.5. The application of Talf1 crude invertase extract (1 %) to a BDS process by *Gordonia alkanivorans* strain 1B at 30 °C and pH 7.5 was carried out through a simultaneous saccharification and fermentation (SSF) approach in which 10 g l^{-1} sucrose and 250 μM dibenzothiophene were used as sole carbon and sulfur sources, respectively. Growth and desulfurization profiles were evaluated and compared with those of BDS without invertase addition. Despite its lower stability at pH 7.5 (loss of activity within 24 h), Talf1 invertase was able to catalyze the full hydrolysis of 10 g l^{-1} sucrose in culture medium into invert sugar, contributing to a faster uptake of the monosaccharides by strain 1B during BDS. In SSF approach, the desulfurizing bacterium increased its μ_{max} from 0.035 to 0.070 h^{-1} and attained a 2-hydroxybiphenyl productivity of 5.80 μM/h in about 3 days instead of 7 days, corresponding to an improvement of 2.6-fold in relation to the productivity obtained in BDS process without invertase addition.

Keywords Invertase activity · *Zygosaccharomyces bailii* strain Talf1 · Biodesulfurization · *Gordonia alkanivorans* strain 1B · SSF · Dibenzothiophene

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