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RESEARCH PAPER

Fructophilic behaviour of *Gordonia alkanivorans* strain 1B during dibenzothiophene desulfurization process

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Biodesulfurization (BDS) aims at the removal of recalcitrant sulfur from fossil fuels at mild operating conditions with the aid of microorganisms. These microorganisms can remove sulfur from dibenzothiphene (DBT), a model compound, or other polycyclic aromatic used as sulfur source, making BDS an easy and environmental friendly process. *Gordonia alkanivorans* strain 1B has been described as a desulfurizing bacterium, able to desulfurize DBT to 2-hydroxybiphenyl (2-HBP), the final product of the 4S pathway, using D-glucose as carbon source. However, both cell growth and desulfurization can be largely affected by the nutrient composition of the growth medium, due to cofactor requirements of many enzymes involved in the BDS biochemical pathway. In this study, the main goal was to investigate the influence of several sugars, as carbon source, on the growth and DBT desulfurization ability of *G. alkanivorans* strain 1B. The results of desulfurization tests showed that the lowest values for the growth rate (0.025 $hour^{-1}$) and for the overall 2-HBP production rate (1.80 μM/hour) by the strain 1B were obtained in glucose grown cultures. When using sucrose, the growth rate increase exhibited by strain 1B led to a higher biomass productivity, which induced a slightly increase in the 2-HBP production rate (1.91 μM/hour), conversely in terms of 2-HBP specific production rate ($q_{2\text{-HBP}}$) the value obtained was markedly lower (0.718 μmol/g/hour in sucrose versus 1.22 μmol/g/hour in glucose). When a mixture of glucose and fructose was used as carbon source, strain 1B reached a value of $q_{2\text{-HBP}} = 1.90$ μmol/g/hour, close to that in fructose ($q_{2\text{-HBP}} = 2.12$ μmol/g/hour). The highest values for both cell growth ($\mu = 0.091$ $hour^{-1}$) and 2-HPB production (9.29 μM/hour) were obtained when strain 1B was desulfurizing DBT in the presence of fructose as the only carbon source, indicating a fructophilic behaviour by this bacterium. This fact is in agreement with the highest value of biomass productivity by strain 1B be in fructose, which resulted in a higher amount cells fulfilling the DBT-desulfurization. The greater number of functional cells conducted to a more effectiveness BDS process by strain 1B, as they attained a $q_{2\text{-HBP}}$ about 74% higher than in glucose grown cultures. Moreover, this significant BDS enhancement can better be observed in terms of the overall 2-HBP production rate, which increased over 5-fold, from 1.80 μM/hour (in glucose) to 9.29 μM/hour (in fructose).

Introduction

The growing use of fossil fuels has led to increased emissions of sulfur oxides into the air, which can cause serious environmental problems, such as acid rain, and also health problems [1]. To avoid the production of such pollutants, sulfur has been extensively removed from fossil fuels before its combustion using a physical and chemical technology called hydrodesulfurization. This technology has some problems to remove sulfur from recalcitrant

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