SUCCINIC ACID PRODUCTION FROM PULP AND PAPER INDUSTRY WASTE - A TRANSCRIPTOMIC APPROACH

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Key Words: Bio-renewable resources, Transcriptome, Succinic acid, Actinobacillus succinogenes

The utilization of renewable resources for the production of bio-based products is essential in order to develop sustainable bioprocesses and biorefineries. Xylose-rich hydrolysates produced from hemicelluloses contained in lignocellulosic resources could be used for the production of succinic acid, one of the most important platform chemicals in the bio-economy era. Exploitation of spent sulphite liquor (SSL), a xylose rich by-product from pulp and paper industry has been previously investigated for succinic acid production by Actinobacillus succinogenes, one of the most efficient natural succinic acid producers. In this study, the metabolic potential of this strain was evaluated through the RNA expression of the metabolic pathways involved in succinic acid production utilizing glucose, xylose or SSL as carbon sources. A transcriptomic approach of the key enzymes of glucose and xylose catabolism, carboxylic acid production as well as oxidative phosphorylation led to an improved understanding on the energy consuming metabolic pathways. The transcriptomic analysis was carried out in batch cultures. A cDNA library was constructed at different phases of the fermentation where major metabolic changes in extracellular metabolites or biomass production were observed. Real time PCR was used to determine the expression levels of the genes of interest throughout the fermentation. The bottlenecks of the fermentative production of succinic acid by A. succinogenes were addressed with particular focus on the effect of glucose and xylose catabolism on pathways that involve ATP consumption and NADH oxidation. All subunits of ATP synthase were highly expressed in all substrates. In particular ATP synthase F0 (ATP SYN F0) was higher expressed when glucose was the only carbon source. Phosphoenol-pyruvate carboxykinase (PEPCK) expression was delayed when xylose was present in the medium. Despite the fact that extracellular lactic acid was not detected, low expression levels of lactic acid dehydrogenase (L