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doi:10.1016/j.jbiotec.2010.08.379

[P-B.27]

Electrochemically active bacteria assisted nitrobenzene removal from wastewater

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Keywords: Bio-electrochemical system; cathode; nitrobenzene; Reduction

Nitrobenzene occurs as a pollutant in wastewaters originating from numerous industrial and agricultural activities. It needs to be removed prior to discharge to sewage treatment works due to its high toxicity and persistence. In recent years, bio-electrochemical systems (BESs), such as microbial fuel cells (MFCs) and microbial electrolysis cells (MECs), have been explored extensively for their innovative features and environmental benefits.

In this study we investigated the use of the novel BES to remove nitrobenzene at a cathode coupled to microbial oxidation of acetate at an anode. The focus of this study was to evaluate the efficiency and feasibility of the overall process, as well as to identify the products of nitrobenzene reduction.

Effective removal of nitrobenzene at rates up to 1.29 ± 0.04 mol m^{-3} TCC d^{-1} (Total Cathodic Compartment, TCC) was achieved with concomitant energy recovery. Correspondingly, the formation rate for the reduction product aniline was 1.14 ± 0.03 mol m^{-3} TCC d^{-1}. Both nitrobenzene removal and aniline formation rates were significantly enhanced when the BES was supplied with power, reaching 8.57 ± 0.03 and 6.68 ± 0.03 mol m^{-3} TCC d^{-1} respectively at an energy consumption 17.06 ± 0.16 W m^{-3} TCC (current density at 59.5 A m^{-3} TCC). Although aniline was always identified as the major product of nitrobenzene reduction at the cathode of BES in this study, the Coulombic efficiencies of nitrobenzene removal and aniline formation were dependent on the current density of the BES. In addition, the concentration of nitrosobenzene, one intermediate of nitrobenzene reduction, was increased with the increase of current density in BES. The COD ratio to nitrobenzene reduction was significantly reduced to 4-5 mol COD mol^{-1} nitrobenzene in the BES system, while this value was normally higher than 20 mol COD mol^{-1} nitrobenzene in the conventional anaerobic biological methods.

doi:10.1016/j.jbiotec.2010.08.380

[P-B.28]

Effects of *ALD6* Overexpression in *Saccharomyces cerevisiae* on bioethanol production in presence of furan-derivatives

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Keywords: Bioethanol; Saccharomyces cerevisiae; Furan-derived inhibitors; ALD6 expression

Bioethanol is the most common renewable fuel today. During pretreatment processes for cellulosic biomass, furan-derivatives such as furfural and 5-hydroxymethylfurfural (HMF) are generated and known to decrease the growth of *Saccharomyces cerevisiae* and hence reduce ethanol productivity significantly. Removal of furfural and HMF in a growth medium by biological or physico-chemical methods is a key factor for obtaining a high fermentation performance. In this study, metabolic enzymes able to convert furfural and HMF to less toxic compounds or to supply reducing powers into the reactions of furfural and HMF detoxification were chosen for the reduction of their negative effects on bioethanol production by *S. cerevisiae*. Among 6 gene candidates from the *S. cerevisiae* genome, the *ALD6* gene encoding aldehyde dehydrogenase 6 was overexpressed under the control of the truncated *HXT* promoter. Batch fermentation in a minimal medium showed 2.2 and 2.3 times higher oxidation of furfural and HMF, respectively, in the *ALD6* overexpressed strain than the control strain. Furthermore, ethanol productivity of the *ALD6* overexpressed strain in batch fermentations containing 1.9 g/L furfural and 0.5 g/L HMF was increased by 33.2% compared to the control strain. Consequently, tolerant properties of *S. cerevisiae* against furan-derived inhibitors were improved by the overexpression of the *ALD6* gene.

doi:10.1016/j.jbiotec.2010.08.381

[P-B.29]

Production of bio-ethanol by simultaneous Saccharification and fermentation process using waste from beer fermentation broth

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Keywords: Bio-ethanol; waste from beer fermentation broth; saccharification; fermentation

Ethanol has attracted global attention because of its potential use as an alternative automotive fuel. Its production from waste sources is one way to reduce both the consumption of crude oil and environmental pollution. Saccharification and fermentation are the two important steps for bio-ethanol production which also determine the process cost. The purpose of our study was to evaluate the feasibility of increased bio-ethanol production from waste of beer fermentation broth (WBFB). WBFB was used for the production of bio-ethanol using the simultaneous saccharification and fermentation process without any addition of saccharifica-