

Vitalized yeast with high ethanol productivity

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Fuel ethanol represents the largest volume of renewable fuels worldwide as an environmentally friendly alternative to fossil fuels. Feedstock and energy consumption contribute to the major cost of bio-ethanol production. High ethanol concentration has always been pursued in the fermentation industry, because significant energy savings can be achieved for downstream distillation and waste distillage treatment.

This work demonstrates that fully water-soluble PEGs are effective for the vitalization of yeast cells for the production of ethanol in very high concentration. The final ethanol concentration was increased to 175 g/L without residue sugar in the fermentation in the presence of PEG-400 supplement, compared to 152 g/L in the absence of the supplement. Very importantly, the yeast cells exhibited substantially extended viability for reuse, and the supplement is readily recoverable for multiple subsequent recycled use. The spent yeast with highly maintained viability can be reued in multiple cycles only by supplementing a much reduced amount of fresh yeast cells. The combination of recycled use of spent yeast and supplement allows the subsequent fermentations at the full efficiency. The results of the present study also imply that reduced water consumption and energy consumption can be achieved by using an optimized amount of the supplement. Largely enhanced ethanol productivity can be achieved by recycling the yeast, which can be expected to help reduce the overall cost. The results of this work further imply that the method may be used in fermentation processes to produce other types of renewable chemicals and bio-fuels.

Keywords: Vitalized yeast; ethanol; fermentaton; supplements; sugars