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Editorial Open Access

Isolation of Thermotolerant Yeast Strains for Ethanol Production: A Need for New Approaches

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Abstract

There is a need for new approaches to isolate thermotolerant yeast strains that can be utilized for the efficient production of ethanol. The simultaneous saccharification and fermentation of starch or lignocellulosic will greatly benefit from thermotolerant yeast strains that actively ferment ethanol at temperatures above 40°C. The development of new procedures targeting the cell membrane to increase thermotolerance in yeast strains represents an opportunity to advance the ethanol industry.

Keywords: Thermotolerant; Ethanol production; Mutant isolation; Yeast

Editorial

Although ethanol production currently accounts for billions of liters of ethanol produced annually from sugarcane or corn, the utilization of thermotolerant yeast strains could improve the efficiency of ethanol production by allowing fermentation to occur at temperatures greater than 40°C [1-3]. With simultaneous saccharification and fermentation of starch or lignocellulosic biomass likely being used to produce ethanol in the future due to its increased productivity at elevated operation temperatures, the isolation of thermotolerant, ethanol-producing yeast strains will be required to ensure that ethanol fermentation occurs. Therefore, the development of novel approaches to isolate thermotolerant yeast strains will be necessary. Prior studies have shown that stress conditions will allow the induction of thermotolerance in the yeast *Saccharomyces cerevisiae* but if the stress conditions are removed the thermotolerance can be lost [4,5]. In a recent investigation, it was shown that thermotolerant *S. cerevisiae* strains isolated by adaptive laboratory evolution to temperatures at 40°C or above had a modification in sterol composition [1]. It was hypothesized that the alteration in sterol composition of these adapted strains resulted in their cell membranes exhibiting optimum fluidity and their increased thermotolerance [1]. An earlier study found that changes in the fluidity of the *S. cerevisiae* cell membrane at high temperatures caused decreased fermentation ability [4]. It may be possible to isolate *S. cerevisiae* mutant strains that are resistant to inhibitors of sterol metabolism or compounds that are known to affect the composition of the cell membrane. It would seem likely that such procedures should allow the isolation of thermotolerant *S. cerevisiae* mutant strains. Another approach relative to thermotolerant ethanol-producing yeast strains would be to examine resistance to the glucose analogue 2-deoxy-D-glucose. Mutant strains of *S. cerevisiae* resistant to 2-deoxy-D-glucose were shown to have an increased ability to ferment [6]. The increase in ethanol production by the *S. cerevisiae* mutant strains was attributed to a lack of catabolite repression by glucose and increased glucose uptake [7,8]. It has been demonstrated that ethanol production by a 2-deoxy-D-glucose-resistant mutant of the yeast *Candida molischiana* was capable of producing ethanol at 45°C unlike its parent strain [9]. The isolation of the majority of *S. cerevisiae* thermotolerant mutant strains reported in the literature have involved "brute force" screening of mutagenized yeast cells, acclimatization treatment of yeast cells or by screening the cells for their ability to grow on a growth-limiting substrate [10-13].

Clearly, the literature exploring methodologies that allow the isolation of stable, thermotolerant mutant strains from ethanol-producing yeast species is limited and further research is needed. The opportunity exists to use such thermotolerant yeast mutant strains to improve the efficiency of ethanol production which should help reduce the current reliance on petroleum-based fuel. To take advantage of this opportunity, new approaches in the isolation of stable thermotolerant yeast mutant strains capable of being used during high temperature ethanol production will need to be developed.

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