GROWTH, SUCROSE METABOLISM AND ETHANOL PRODUCTION IN SACCHAROMYCES CEREVISIAE CELLS WITH HIGHER PLASMA MEMBRANE H⁺-ATPASE ACTIVITY

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Ethanol, a renewable energy source, can be considered as a good alternative to replace fossil fuels. Currently, America is the largest ethanol producer, with United States and Brazil leading global production. Saccharomyces cerevisiae is the main agent involved in fermentative production of ethanol. Some microorganisms have lower energetic efficiency during fermentation, but have higher ethanol production. Thus, it is possible that the reduction of energetic efficiency in S. cerevisiae during fermentation process could lead to an increase in ethanol production. The objective of this work was to study growth, sucrose metabolism and ethanol production by Saccharomyces cerevisiae cells displaying higher plasma membrane H⁺-ATPase activity. Initially, we evaluated cell growth in strains PJ69 (wild type) and arg82Δ (deletion that increases plasma membrane H⁺-ATPase activity). These strains were grown on medium containing sucrose as carbon source at different concentrations (2, 4, 8 and 15%). Ethanol production was quantified by gas chromatography and sucrose metabolism was assessed by invertase activity and transport by Agt1p (alpha-glucoside transporter) and performed as previously described in the literature. Sucrose concentration had no effect on strains specific growth rate, however, arg82Δ showed lower growth rate when compared to wild type. PJ69 displayed higher sucrose consumption at concentrations of 8 and 15% when compared to arg82Δ. Nevertheless, at the end of fermentation, both strains reached same consumption levels, with the exception of 15% grown cells. Strains PJ69 and arg82Δ do not differ with respect to sugar transport. However, wild type strain showed higher invertase activity. In media containing 2 and 4% of sucrose, ethanol production was similar to both strains. PJ69 produced higher ethanol yields than arg82Δ in cell cultures with 8 and 15% of sucrose. These results indicate that possibly the lack of Arg82p and/or higher H⁺-ATPase activity have a negative effect on sucrose metabolism and ethanol production.

Keywords: ethanol, H⁺-ATPase, Saccharomyces cerevisiae
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