VERSITA

Cent. Eur. J. Biol. • 8(8) • 2013 • 724-729
DOI: 10.2478/s11535-013-0186-1

Central European Journal of **Biology**

Li^+ effect on the cell wall of the yeast *Saccharomyces cerevisiae* as probed by FT-IR spectroscopy

Research Article

Aurelijus Zimkus[1,*], Audrius Misiūnas[2], Larisa Chaustova[3]

[1]*Department of Biochemistry and Biophysics, Vilnius University, LT-01513 Vilnius, Lithuania*

[2]*Department of Organic Chemistry, Center for Physical Sciences and Technology, LT-01108 Vilnius, Lithuania*

[3]*Department of Bioelectrochemistry and Biospectroscopy of Institute of Biochemistry, Vilnius University, LT-01513 Vilnius, Lithuania*

Received 29 November 2012; Accepted 18 March 2013

Abstract: The effect of Li^+ ions as a transformation inducing agent on the yeast cell wall has been studied. Two *Saccharomyces cerevisiae* strains, p63-DC5 with a native cell wall, and strain XCY42-30D(*mnn1*) which contains structural changes in the mannan-protein complex, were used. Fourier transform infrared (FT-IR) spectroscopy has been used for the characterization of the yeast strains and for determination of the effect of lithium cations on the cell wall. A comparison of the carbohydrate absorption band positions in the 970-1185 cm^{-1} range, of Na^+ and Li^+ treated yeast cells has been estimated. Absorption band positions of the cell wall carbohydrates of p63-DC5 were not influenced by the studied ions. On the contrary, the treatment of XCY42-30D(*mnn1*) cells with Li^+ ions shifted glucan band positions, implying that the cell wall structure of strain XCY42-30D(*mnn1*) is more sensitive to Li^+ ion treatment.

Keywords: *FT-IR spectroscopy • Lithium • Saccharomyces cerevisiae • Transformation*

1. Introduction

The capacity of metal cations to induce competence of yeast and bacterial cells to exogenous DNA is the basis of biological methods in biotechnology and molecular genetics [1-3]. The most commonly used, efficient protocol, for genetic transformation of *Saccharomyces cerevisiae* is treatment with alkali metal ions. Li^+ ions are the most effective of all the cations tested, and the transformation efficiency is comparable to levels obtained by the protoplast method [4]. Li^+ ions enhance the transformation of intact cells, but no effect is observed on transformation of protoplasts, implying that Li^+ ions facilitate DNA passage through the cell wall [5]. The mechanism underlying *S. cerevisiae* transformation includes DNA attachment and penetration through the cell wall, although how DNA passes through the cell wall is not yet clear [6-8]. Cell wall density, thickness and structure are factors of major importance during penetration of exogenous molecules into the cell. However, despite the extensive use of Li^+ ions in yeast transformation protocols, the influence of these cations on the structure of the yeast cell wall has not been widely investigated and, therefore, remains unclear. The influence of Li^+ ions on the cell surface topography of intact *S. cerevisiae* cells was observed by atomic force microscopy and it was found that the surface of Li^+ treated yeast cells became much rougher [9].

The *S. cerevisiae* cell wall is composed of three major components: β-glucans, chitin, and mannoproteins. Glucose residues are linked to other glucose molecules through β(1→3) and β(1→6) linkages and to *N*-acetylglucosamine *via* β(1→4) bonds [10,11]. *S. cerevisiae* mannan has a linear α(1→6)-linked

* *E-mail: aurelijus.zimkus@gf.vu.lt*