

Bioaccumulation of some toxic heavy metals by yeast transformants

(Received: 27.05.2000)

Fatma M. Hafez and Nivine A. Abosreh

Microbial Genetics Department, Genetic Engineering and Biotechnology Division,
National Research Center, Dokky, Cairo.

ABSTRACT

Transformation of *Saccharomyces cerevisiae* SC₁₄ recipient cells and the bioaccumulation of heavy metal ions were studied. *S. cerevisiae* SC₁₄ can be rendered competent for DNA uptake by a temperature shock of the recipient cells in the presence of high concentrations of either Ca²⁺ or Mg²⁺ ions. Uptake of foreign DNA, for which the presence of heavy metal ions is essential, was possible during the temperature shock but appeared to occur most readily after a heat shock during incubation at 0°C. When foreign DNA was added to the cells before the heat shock in the presence of divalent cations DNA uptake was very low. Such treatments may cause changes in lipids in the biological membrane. The combination of temperature changes and a high concentration of either Ca²⁺ or Mg²⁺ could lead to specific changes in the cell membrane, allowing DNA uptake in the presence of DNase.

Under conditions used to induce competents, some transformed isolates were capable to accumulate some toxic heavy metal ions such as Fe, Zn, Mn and Cu. Results show that most yeast transformants were inhibited by the different concentrations of the tested heavy metal ions. The degree of inhibition varied from one transformant to the other. It is interesting to notice that three isolates did not show any inhibitory effect as detected by inhibition zone on tested transformants at the concentration 0.217 µg of Zn. It is also interesting to notice that these isolates did not exhibit the same trend with the different heavy metals, as they were capable to grow up to 0.542 µg of Zn. These three yeast isolates are considered as transgenics for Zn tolerance. This means that genetic behavior of transformants growth varied from one heavy metal to the other.

Key words: Toxic heavy metals, DNA, temperature shock, transformation, *Saccharomyces cerevisiae*.

INTRODUCTION

Genetic transformation is generally applicable to most genera (Bibb *et al.*, 1978; Change and Cohen, 1979 and Katsumata *et al.*, 1984), but it is difficult to establish the best conditions for transformation, and the methods are often not reproducible.

Uptake of free DNA by yeast cells can only be achieved when the recipient cells have been made competent followed by a heat shock in the presence of Ca²⁺ ions as first reported by Mandel and Higa (1970). Several modifications of the latter method are now widely used for transformation. (Cohen *et al.*, 1972, Dagert and Ehrlich 1979 and Humphreys *et al.*, 1989).