Effects of Trehalose and Ethanol on Yeast Cytosolic Pyrophosphatase

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Trehalose has been described to protect several enzymes against destabilizing conditions. This sugar is naturally accumulated by yeast as a stress protectant. A common stress condition that yeast is normally submitted is the presence of ethanol, the by-product of fermentation process of several yeast. In this paper we show the effects of trehalose and ethanol, alone or together, on yeast pyrophosphatase, and the effects of these compounds on inhibition and unfolding of pyrophosphatase promoted by urea. We show that both trehalose and ethanol inhibit pyrophosphatase in a dose-dependent manner, and that the presence of ethanol does not modify the inhibition promoted by trehalose as well as the presence of trehalose does not modify the inhibition promoted by ethanol. The effects of trehalose on pyrophosphatase are completely reversible, but the inhibition caused by ethanol was only partially reversible. Incubation of pyrophosphatase with 10% (v/v) ethanol promoted an inhibition of 15%, and the control activity was completely recovered after removal of ethanol. On the other hand, when pyrophosphatase was incubated with 20% (v/v) ethanol an inhibition of 40% of the control activity was observed which persisted after removal of ethanol. Ethanol also potentiates the inhibition of pyrophosphatase promoted by urea, and contributes for an irreversible inactivation and unfolding of pyrophosphatase in the presence of urea. Trehalose, that protects this enzyme against the inhibition and unfolding promoted by the chaotropic compound urea, was inefficient to protect against the effects of ethanol. Trehalose was also efficient to prevent an irreversible inactivation induced by urea.

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