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The Action Mechanisms of Acetic Acid Stress on Industrial Strains of *Saccharomyces Cerevisiae* Under Fermentation and Respiration

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ABSTRACT

Acetic acid (AA) is a natural by-product of ethanol fermentation and widely exists in lignocellulosic hydrolysate as a fermentation inhibitor since its high concentration damages proteins and nucleic acids. The study of the action mechanisms of AA at a pH lower than its pKa (4.76) is particularly relevant since it disrupts the function of cellular membranes by altering the conformations of membrane proteins and lipid organization. This study aims to investigate the molecular mechanism of AA influence in industrial strains of *S. cerevisiae* (ATCC 9804 and ATCC 13007) depending on metabolic condition (fermentation versus respiration) and external pH (3.0 or 4.5). The results show that 10-50 mM AA reduces the viability of both strains studied. Moreover, the ATCC 13007 strain is more sensitive to AA stress compared to the ATCC 9804 strain. Yeast resistance to AA stress is higher under respiratory metabolism compared to fermentation and at higher pH. Catalase activity was observed to increase by 1.5-6-fold under AA stress conditions, which correlates with yeast growth changes. The influence of AA stress is reactive oxygen species-dependent, and redox balance regulation was found to increase yeast robustness to AA by 2-fold. The study anticipates valuable insights into yeast adaptation to stress conditions, contributing to the development of robust yeast strain construction for biotechnological advancements in bioethanol or yeast protein production.

Keywords: *Saccharomyces cerevisiae*, acetic acid stress, antioxidant defense, redox balance

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