The Effects of Alkaline and Acidic Substances on Catalase Functionality and Molecular Structure

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The disposal of hydrogen peroxide is crucial for organismal health as hydrogen peroxide is a toxin that causes necrosis, apoptosis, gangrene, ulcers, susceptibility to other medical conditions, and overall damage to tissue and organ health. Catalase is the enzyme that breaks hydrogen peroxide into water and oxygen gas. The project's purpose was to analyze the efficiency and overall functionality of catalase under environments of different pHs. Yeast containing catalase was combined with twenty grams of variable substances each chosen to represent specific pH's. Hydrogen peroxide was added to the solution and the amount of oxygen released was measured by displacement using aquarium tubing and an inverted water-filled graduated cylinder. Sodium hydroxide - the only alkaline substance that had a significant effect - decreased functionality the most. There was nearly consistent interference in oxygen production on the acidic end of the pH scale (pH 1-4), showing that acidity has a prominent effect on catalase functionality. Analysis of protein structure showed that substances of high acidity cause protein misfolding on both secondary and quaternary levels as well as active site interference. On the alkaline side, the surplus of hydroxide ions also causes protein misfolding on the quaternary or secondary levels; however, this was only visible with one alkaline substance. Acidity or high alkalinity affects the molecular structure of catalase, inhibiting its functionality. Therefore, the acidity of the blood and liver can lead to deterioration of organs and tissues due to catalase's inhibition. This information could be applied to the development of health complications due to blood and liver acidity.

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