Utilizing a Systemic Design of an Artificial Cell to Evaluate the Efficacy of Multiple Factors that Influence Catalase Activity

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Acatalasemia, better known as the lack of the necessary amount of active catalase enzymes in the body, has been linked to diseases such as type 2 diabetes and colorectal cancer. This disease has not been studied large scale in the US, but is predicted to occur among one in every 30,000 individuals. This project explores the development of a novel, artificial cell that has the potential to increase catalase activity. To come up with the perfect solution for the artificial cell, multiple ways of catalase renaturation were tested. These included attempting to fold the enzyme by influencing the acidity of the surrounding environment as well as using a coenzyme to aide in catalase activity. To measure changes in the output of various solutions, hydrogen peroxide was decomposed in a sealed container and oxygen change was measured over a 20 minute period. Beta Nicotinamide Adenine Dinucleotide (NAD) was determined to be the most viable coenzyme to use in the solution as it was effective, but not to the point in which it would cause hyperoxia. When contained in an artificial cell, NAD paired with catalase raised the oxygen level by over 40% in 20 minutes. Salt was also added into an artificial cell with NAD and catalase, which yielded a 47% oxygen change, suggesting that it would be the most viable solution to put in a pill. These results suggest that if the supplement was ingested, one’s catalase activity would raise.

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