

Tuning the bacterial system for high production of Super vitamin Coenzyme Q10

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Specific problem being addressed: Coenzyme Q10 is considered a miracle molecule and super Vitamin-Q. This molecule is known to increase body energy production through ATP. It helps treat various human diseases such as cardiomyopathy, muscular dystrophy, Parkinson's, Alzheimer's disease, diabetes, periodontal disease, and early stages of congestive heart failure. It has excellent antioxidant and free radical scavenging properties; hence it helps reduce signs of aging by preventing the damage caused by free radicals and oxidative stress and helps in protecting membrane protein and phospholipids from lipid peroxidation. Until now, chemical synthesis, metabolic engineering, and bacterial mutant selection methods have been found to be prominent routes for improving the production of CoQ10. However, these strategies have almost reached their saturation level due to limitations associated with them and hence are insufficient to meet the growing market demand.

Project Summary: Currently, chemical synthesis, metabolic engineering, and bacterial mutant selection methods are being used to improve the production of Co-Q10; however, there are some challenges associated with these technologies, and they are unable to meet the market. We propose a synthetic biology-based approach to mitigate the above-mentioned challenges. We propose Coenzyme Q10 using two approaches using genetic modification and microbial fermentation.

Approach 1: *Co-Q10 Preparation using Heterologous producers*

Approach 2: *CoQ10 Preparation using Native producers*

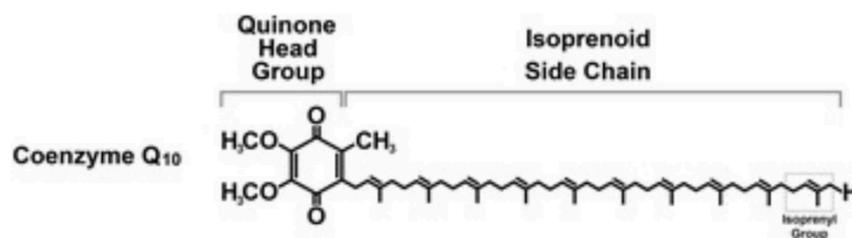


Figure:1- Chemical Structure of Coenzyme Q10¹²

Impact of this innovation: Co-Q10 has emerged as a product of high market demand due to these potential therapeutic advantages, which led to the requirement for a high-yield (10-12 g/l) production process. Researchers across the globe are working to develop a cost-effective and commercially viable bioprocess to meet the soaring demand. Its market turnover was 575 million USD in 2020 and is expected to cross 1.15 billion USD by 2027. Japan is a major production and consumption hub for CoQ10 and accounted for over 20% of global consumption alone in 2015. At present industrial production using *E. coli* has achieved a maximum of 3.63 mg/g DCW; however, the soaring demand for this product requires a 10-12 g/l titer generating process. Hence, the proposed new strategy using synthetic biology will take CoQ10 production to its next level, probably 7-8 g/L, where it can meet the current industry requirement.



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