Resveratrol Biosynthesis in Genetically Engineered Microorganisms

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Resveratrol is a natural plant product that has anti-tumor, anti-cancer, and life-span increasing properties in humans. However, extracting resveratrol from plants such as grapes and peanuts is inef?cient, utilizes many toxic chemicals, and requires consumption of substantial natural resources. The objective of this study was to investigate the feasibility of using engineered microorganisms to produce resveratrol at greater efficiency and lower cost. To achieve this goal, we co-expressed genes coding for the enzymes 4-coumaric CoA ligase (4CL) and stilbene synthase (STS) in microorganisms Escherichia coli (E. coli) BL21 and Saccharomyces cerevisiae (S. cerevisiae) BJ5464-NpgA, and p-Coumaric acid was fed to the organisms as a substrate for resveratrol biosynthesis. The produced compounds were extracted and analyzed by liquid chromatography–mass spectrometry (LC-MS) and nuclear magnetic resonance (NMR) imaging. It was determined that the combination of the 4CL and STS genes were capable of synthesizing resveratrol from p-coumaric acid. The tyrosine ammonia lyase (TAL) gene was then transformed into the organisms to eliminate the need to feed p-coumaric acid. Subsequent analysis by LC-MS determined that the engineered strains of microorganisms can produce resveratrol at concentrations of 100mg/liter. This is 100 times more concentrated than what is found in red wine and a higher yield than other methods of microbial production of resveratrol. The results of this study show that engineered microorganisms can be effectively used as a low-energy and low-waste alternative for resveratrol production in the biomedicine and the food and drug industry.

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