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Biosynthetic Engineering of Benzaldehyde in S. Cerevisiae

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Abstract

Plant derived natural products have found uses in medicine, food, and other settings. For example, taxol (an anticancer drug), artemisinin (antimalaria drug), and vanillin (flavoring agent and spice) are all plant derived. Despite the importance of natural products, the enzymes responsible for making them are unknown in many cases. Therefore, scientists extract the natural products directly from plants or use chemical synthesis. These methods, while effective, face drawbacks. A possible solution is biosynthetic engineering of the desired product in chassis organisms. For biosynthetic engineering, the pathway genes must be known. One notable plant derived compound, which serves as a pollinator attractor and as an antifungal, is benzaldehyde. Because of its almond-like smell and taste, benzaldehyde has many uses in the cosmetic and flavor industries. After much effort, the enzyme responsible for benzaldehyde production, benzaldehyde synthase, was identified in 2022, allowing for production of benzaldehyde in organisms such as S. cerevisiae. In this work, we design a S. cerevisiae strain that can produce benzaldehyde from phenylalanine by expressing the on-path genes from Petunia hybrida cv. Mitchell flowers. Producing benzaldehyde using an engineered yeast strain can provide scientists with a method that is scalable, results in high-yields, and is environmentally friendly.

Keywords: benzaldehyde, biosynthetic engineering, enzyme identification, natural products, yeast