Isopentenyl Phosphate Kinase (IPK) Mutants with Altered Substrate Preferences

INVENTION:
Terpenoids are a large and diverse class of naturally occurring chemical compounds, which play essential and specialized roles, including modulation of membrane fluidity, defense and communication, photoprotection and energy transfer, protein prenylation, and growth regulation. Isopentenyl Phosphate Kinase (IPK) phosphorylates isopentenyl phosphate (IP) and its isomer dimethylallyl phosphate (DMAP) resulting in the production of IPP and DMAPP, the universal building blocks of all naturally occurring terpenoids. Investigators at the Salk Institute have rationally engineered isopentenyl phosphate kinase (IPK) mutants capable of accepting longer chain substrates. These mutant enzymes were able to phosphorylate alternative substrates, including farnesyl monophosphate (FP). The altered substrate preference of these enzymes can be exploited to increase production of specific terpenoids or their precursor molecules. Terpenoids have traditionally been produced by extraction from various natural sources or chemical synthesis using petrochemicals. Due to the minute quantities found in starting materials, extraction yields are often very low, resulting in high prices and limited supplies for many of these important compounds. Development of more efficient and reliable biosynthetic methods for terpenoid production is of great value for this important class of chemicals.

APPLICATIONS:
- Biosynthesis of terpenoids
- Production of renewable chemicals
- Production of biofuels, fragrances, cosmetics, pharmaceuticals, nutritional supplements and agricultural products

ADVANTAGES:
- Produced from renewable sources
- Increased yields compared to traditional extraction methods
- Decreased dependence on fossil fuels

STAGE OF DEVELOPMENT: In vitro

BACKGROUND:
Terpenoids have many industrial applications across many different industries, including the pharmaceutical, nutritional supplement, cosmetic and fragrance, agricultural, chemical and biofuel industries. Due to the importance of these molecules and the large quantities needed for different industrial applications, there remains a need for more efficient and cost effective methods for terpenoid production.

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PATENT STATUS: U.S. Patent 9,051,555; Pending US application 14/701,389

PUBLICATIONS: Dellas N, and Noel JP. ACS Chem Biol. 2010 Jun 18;5(6):589-601.

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TECHNOLOGY ID: RD1209