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Enzymes and Microorganisms for the Production of 1,3-Butadiene and Other Dienes

1,3-butadiene is a highly useful chemical building block that is instrumental in the production of many fine and commodity chemicals. It is also an intermediate chemical in the production of synthetic rubbers. These rubbers have a wide range of applications across many fields, from tire production to medical equipment. The conventional method of 1,3-butadiene production relies heavily on non-renewable petroleum resources. The annual global demand of 1,3-butadiene is about 11 million tonnes, so fluctuations in petroleum prices impact its production. Microbes engineered to produce 1,3-butadiene from sustainable resources could provide an alternative method of production, but require engineering to enable synthesis at high levels.

Researchers at Arizona State University have discovered a key pathway enzyme in the production of 1,3-butadiene from a renewable substrate. The discovered enzyme gene encodes for polypeptides that display 2,4-pentadienoate decarboxylase activity, allowing for the conversion of 2,4-pentadienoate to 1,3-butadiene. Using this discovery, researchers at Arizona State University have developed an alternate method of 1,3-butadiene production. By incorporating the discovered enzyme genes into recombinant host cells which have also been engineered to synthesize 2,4-pentadienoate (as is potentially possible from muconic acid), 1,3-butadiene may be produced from fermentable substrates instead of non-renewable petroleum resources.

This technology provides an alternative 1,3-butadiene production method that is more sustainable and inexpensive than the current methods being utilized.

Potential Applications

- Production of synthetic rubbers with applications in numerous fields, such as tire manufacture, plastics, textiles, medical equipment, and other areas
 - o Styrene-butadiene rubber, polybutadiene rubber, neoprene, nitrile rubber, SB Latex, hexamethylenediamine, and more
- Production of fine and commodity chemicals/biochemicals
- Production of bioplastics

Benefits and Advantages

- Enables production of 1,3-Butadiene from renewable substrates, such as glucose
- Avoids reliance on non-renewable petrochemicals which are dependent on the crude oil and natural gas market
- The recombinant host can be selected from bacteria, yeast, fungi, cyanobacteria, algae and plant cells

For more information about the inventor(s) and their research, please see [Dr. Nielsen's directory webpage](#)