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# Microbial Conversion of Glucose to Styrene and Derivatives

**AzTE Case # M11-063**


**Inventors**

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## Invention Description

Styrene is a versatile monomer that is widely used to produce polystyrene and other polymers. Styrene is typically produced by the chemo-catalytic dehydrogenation of petroleum-derived ethylbenzene. This process is both highly energy-intensive and uses non-sustainable feedstocks. For these reasons, a means to produce styrene that is more efficient, less expensive, and more sustainable would have immediate applications.

Researchers at Arizona State University have engineered a strain of *E. coli* that uses sustainable carbohydrates (sugars) as a substrate to produce styrene. Small cultures (50 mL volume) of this recombinant E. coli strain produced more than 7mg (140 mg/L) of styrene within 24 hours. An additional gene can be incorporated to convert the styrene to styrene oxide (used in the production of some cosmetics and pharmaceuticals).

This method is scalable to industrial volumes and promises the ability to produce important chemical and pharmaceutical monomers in a manner which is efficient, economic, and sustainable.

## Potential Applications

- Production of styrene monomer for
  - polystyrene
  - other polymers and copolymers
- Production of styrene oxide for
  - pharmaceuticals (such as levamisole, used in dermatology)
  - cosmetics

## Benefits and Advantages

- Sustainable – uses carbohydrates or sugars, such as glucose, as the feedstock
- Lower energy requirements and greater economy compared to existing methods (which require $>10^7$ BTU of steam/ton of styrene produced)
- Produces enantiomerically pure compounds requiring no purification steps

**Intellectual Property Status:**
*Patent Pending*

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