



## Microorganisms Engineered to Produce Phenol and its Derivatives

AzTE Case # M13-199

### Inventors

#### David R Nielsen

Assistant Professor  
Department of Chemical  
Engineering  
Arizona State University

#### Shawn Pugh

Graduate Research Assistant  
Department of Chemical  
Engineering Arizona State  
University

#### Brian Thompson

Graduate Research Assistant  
Department of Chemical  
Engineering Arizona State  
University

### Intellectual Property

#### Status:

*Patent Pending*

### Contact

*Yash Vaishnav, PhD, MBA*

Vice President

Business Development, Life  
Sciences

Arizona Technology  
Enterprises, LLC (AzTE)

P: 480.884.1648

F: 847.971.2871

[YASH@AZTE.COM](mailto:YASH@AZTE.COM)

[HEALTHSCIENCES@AZTE.COM](mailto:HEALTHSCIENCES@AZTE.COM)

### Invention Description

The market interest in biosynthesis of important commodity chemicals is steadily growing, driven by sustainability concerns and by increased environmental awareness. However, most production technologies rely on petroleum or food crops as feedstocks. Phenol is one such useful and versatile chemical, which is typically derived from petrochemical feedstocks; thus its market price is tightly correlated with that of crude oil. In the coming decades, it is hoped that materials made from renewable sources will gradually replace non-renewable petrochemical-based materials.

Researchers at Arizona State University have developed novel enzymatic pathways and engineered microorganisms for the *in vivo* production of the building blocks phenol, catechol and *cis,cis*-muconic acid from renewable fermentable substrates. Using a single host microorganism, all three compounds can be produced with high levels of production. All of these products are highly useful for the synthesis of numerous chemical and polymer products.

The ability to synthesize these chemicals, which are conventionally derived from non-renewable petrochemical resources, significantly contributes to the advancement and development of green and sustainable materials and products.

### Potential Applications

- Bioproduction of:
  - Phenol
  - Catechol
  - *Cis,cis*-muconic acid

### Benefits and Advantages

- Uses inexpensive and sustainable resources for the substrates, such as carbohydrates and sugars
- High level production at high substrate yields
- Limited diversity and quantity of by-products
- Only one host microorganism needed for production of all three compounds