Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

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Case ID:M06-143L
Published: 3/22/2019

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Production of Bioplastics and other biomaterials from the Cyanobacterium Synechocystis

The biopolymer market has been expanding rapidly, but many biopolymer technologies rely on petroleum or conventionally derived agricultural feedstocks. In the coming decades, materials made from renewable sources are expected to gradually replace non-renewable petrochemical-based industrial materials, including polymers. The production of plastics from renewable biopolymers will offer several advantages over conventional petroleum-based plastic production. These advantages include having reliable (domestic) suppliers, sustainable production, lower greenhouse gas emissions, competitive pricing, and increased number of jobs in rural communities.

Researchers from Arizona State University have recently developed a new technology to produce biopolymers from autotrophic cyanobacteria that optimizes the production of biopolymer during the life-cycle of the organism. This technology uses CO2 from the environment, and unlike plant based biopolymer technologies, the production is compact and versatile, and does not compete with foodstocks. The researchers have found the technology can be used to produce a variety of high-value biopolymers, including Cyanophycin, Polyhydroxyalkanoates (PHA) and Poly(3-hydroxybutyrate).

Potential Applications

- Polymer feedstock - biopolymers/bioplastics industry - will provide biodegradable raw materials to a variety of other industries
- Medical industry – medical devices requiring biodegradable plastics including sutures, bone plates, surgical mesh, pins, stents, etc.
- Pharmaceutical industry – drug delivery devices

Benefits and Advantages

- Green/Sustainable:
  - Removes CO2 from environment
  - Replaces non renewable petroleum based plastics with biodegradable sources
  - Low reliance on petroleum for production
  - Biopolymers can serve as raw materials in a wide variety of applications
- Tunable and resilient production – to give the best economies of production and scale
- Compact production – current technologies require vast quantities of farmland to produce feedstocks; cyanobacterial aquaculture has low space and energy requirements and does not compete with food production
- Cost effective – requires less energy and raw material input than other methods based on fermentation

For more information about the inventor(s) and their research, please see Dr. Vermaas' departmental webpageDr. Vermaas' research webpage