Biofuel production from iron-oxidizing bacteria using carbon dioxide as a fuel source

There is a great need for an efficient production of biofuels without the use of agricultural inputs. Genetically modified organisms that can to create these chemical species using their own machinery have been investigated as a potential solution to fulfill this growing demand. This invention describes a method to efficiently generate biofuels and other chemicals using iron-oxidizing bacteria. These genetically modified bacteria are able to couple to electrochemical process to convert electricity, water, and carbon dioxide (CO2) into biofuels. A bioreactor containing the iron-oxidizing bacteria fix CO2, powered by media rich in ferrous ions. This electron source is oxidized into ferric ions by the organisms, which can then be regenerated electrochemically before being reintroduced into the reactor for continuous fuel production.

Iron-oxidizing bacteria provide an easier and more cost efficient alternative to ammonia-oxidizing species

Alternative methods to generate biofuels currently use ammonia-oxidizing organisms, which are difficult to perform and expensive. This technology uses the electrochemical conversion of ferric ions back to ferrous ions which is a relatively simpler process and more cost-effective. By utilizing this process, the technology can potentially lead to substantial decreases in electrical power requirements. Additionally these bacteria thrive in conditions where most others cannot, yielding a decreased cost to maintain the genetically engineered colony.

Media additives supplement the system and have been shown to support efficient cell growth at optimal pH levels along with increased iron concentrations. From this fuel source, insoluble ferric ions were demonstrated be converted to soluble ferrous ions using a laboratory bioreactor.

Lead Inventor:
Scott A. Banta, Ph.D.
Applications:

- Generate biofuels and other chemicals using a bioreactor powered by iron-oxidizing bacteria.
- Provide a media to prevent insoluble ferric iron deposits through conversion to soluble ferrous ions.

Advantages:

- Provides an easier method to generate biofuel from CO2 than ammonia-oxidizing systems.
- Decreases electrical power requirements through use of a reusable media rich in ferric ions.
- Decreases cost to maintain genetically modified colonies by using organisms that thrive in harsh environmental conditions.
- Decreases land requirements seen with common agricultural biofuel generation.

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Related Publications:


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Inventors

Scott A. Banta