



A novel, low-cost, continuous process for producing PHA using agricultural wastes as a substrate for mixed microbial cultures

Bioplastics offer a promising alternative to the pollution problems caused by conventional plastics. Polyhydroxyalkanoates (PHAs) are a fully biodegradable family of bioplastics, that can be produced by bacteria. They are suitable for many applications but are more expensive to produce. The AgriLoop project is investigating a novel, low-cost, continuous process for producing PHA using agricultural wastes as a substrate for mixed microbial cultures (MMC).

Project activity

A laboratory-scale, continuous, MMC-PHA process has been developed, consisting of three stages: aerobic microbial selection, PHA accumulation and anaerobic quenching. Microbial selection is via a continuously fed feast reactor linked to a continuously stirred famine reactor. From there, part of the biomass is recirculated to the feast reactor, and the rest goes to a continuously fed PHA accumulation reactor. The PHA-rich biomass is continuously sent to a quenching tank that inhibits microbial activity via acidic or thermal shock. Over 170 grams of the Poly(hydroxybutyrate-hydroxyvalerate) (PHBV) copolymer was recovered, with purity from 65 to 92%, wt/wt and interesting characteristics for future applications. These initial tests used synthetic mixtures of carboxylic acids as feedstock, but future activities will test the use of agri-food wastes (e.g. fermented wine lees and potato peels).

Key findings and recommendations

The research found that a continuous MMC-PHA production process is recommended over conventional batch processes to achieve the following benefits:

- The feast and famine phases of microbial selection are spatially separated, avoiding the need for computerized monitoring to control the reactor phases or an oxygen probe to identify the end of the feast phase.
- The ratio between the recirculation flow rate between the feast and famine reactors and the influent flow rate to the feast reactor can be adjusted to maximize PHA productivity.
- High PHA purity and high molecular weight can be obtained with a chlorine-free extraction procedure.



References

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For more information about the AgriLoop Project, visit:

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