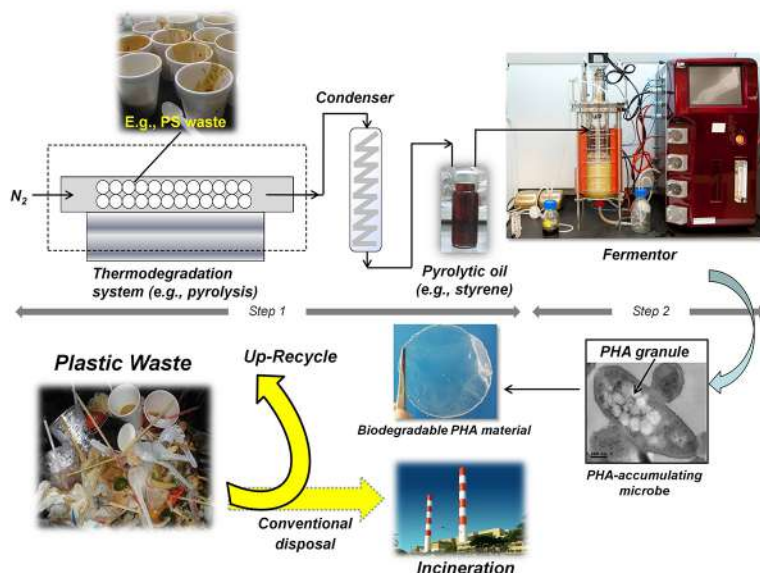


Conversion of Municipal Plastic Waste into An Innovative Polyhydroxyalkanoate (PHA) Material

Overview

In Singapore, plastic waste ranks as the fourth largest waste stream. However, plastic is also one of the least recycled solid wastes. Annually, about 600,000 tonnes of plastic waste end up at incineration plants. These wastes represent an invaluable pool of resources that could be up-recycled to make PHA materials instead of going into incineration plants. PHAs are naturally synthesized by special microorganisms using renewable carbon sources. PHAs are biodegradable and biocompatible polymers with potential niche applications such as disposable packaging material, in drug delivery, or even as wound-healing scaffolds and devices.



Description

Currently, PHA production methods, which use pure sugar or glucose, are costly and result in more expensive PHA products. Waste, on the other hand, is a cheaper feedstock. Thus, the proposed project is expected to reduce the cost of PHA material and encourage an active exploration for novel uses of PHA. The proposed biotechnology is a two-step process. In the first step, plastic waste is exposed to high temperature, in an anaerobic environment, to break down the polymer into gaseous hydrocarbon products. This step is known as pyrolysis. The gases are next passed through a condenser and cooled down to form a hydrocarbon-rich oil mixture. In the second step, the oil mixture will be fed to special microorganisms that can utilize them to make PHAs. The process is shown in the schematic diagram below.

Objective

- The project targets to develop a biotechnology that allows Singapore to mine resources from municipal plastic waste and to utilize the resources for the production of biodegradable polyhydroxyalkanoate (PHA) materials.

The project constitutes a sustainable waste management model in the

- Up-recycling of waste helps to reduce the pressure on building more incineration plants and, in turn, divert incineration ashes away from the landfill and hence help to prolong the lifespan of Pulau Semakau.
- Waste minimization by using waste as a starting material to generate a new resource, PHA.
- There is a market demand for PHA materials and used PHA materials can be recycled and manufactured into PHA-based plastic products. Hence this would help to close the waste loop for the material.