# Producing useful bioplastics from the gasification of urban waste

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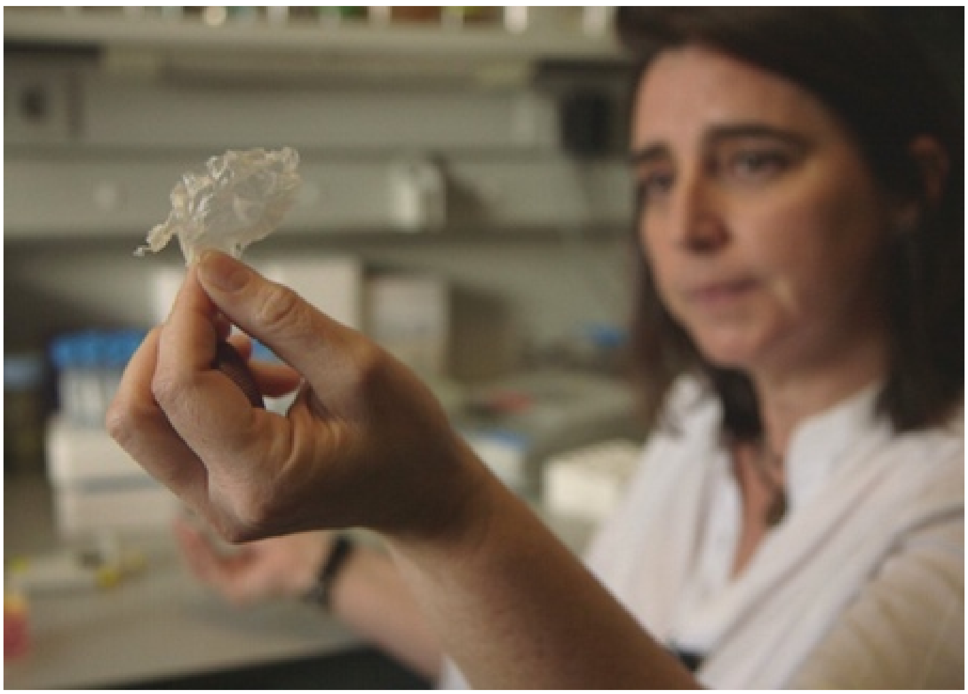

Bacteria may be the key to produce useful bioplastics from the gasification of urban waste.

Each year, the European Union produces three billion tonnes of waste. This equates to six tonnes of solid waste for every EU citizen, according to Eurostat. A major challenge is findings ways to reduce and reuse a large amount of such waste. Until now, research has focussed on deriving gas from urban waste. Now, the Synpol project, funded by the EU and due to be completed in 2016, has found ways to "employ" bacteria to ferment such gases to produce bioplastics.

The project team has found that mixtures of bacterial species may enhance efficiencies of conversion. Such bioplastic compounds, might have multiple applications, from the bioplastic used in medical prosthesis, to applications in packaging. The project may, in the future, not only benefit management of terrestrial wastes but also reduce the harmful environmental impact of petroleum-based plastics. "More than 25 million tons of plastics are disposed of annually in EU landfills or directly into the environment, posing a huge environmental burden due to their recalcitrance towards degradation," says José Luis García López, professor of environmental biotechnology at the Biological Research Centre (CIB), in Madrid, Spain, who is also the project coordinator.

Complex waste raw materials, such as municipal and chemical waste, contain a lot of reusable carbon that bacteria can digest and transform into biopolymers. This is the starting point of the project. The process under development follows three steps. After compression, the waste is first pyrolysed before being gasified to produce syngas, a synthetic fuel gas. Syngas is used to derive carbon monoxide or dioxide, and hydrogen.

One of the big challenges is to develop the best technology to obtain such gases from waste. The project team has worked on different reactors for gasification. For now, the most efficient solution is a novel microwave pyrolytic waste treatment reactor. In parallel, the treatment is coupled to fermentation techniques, using recombinant bacteria to produce bioplastic compounds. At this stage, researchers are testing the efficiency of different microorganisms. Some of them are better with hydrogen, others with carbon monoxide. But they are all able to transform the residual gas into a biopolymer. Now, researchers are looking to determine which bacteria are more efficient and are also testing mixtures of different species.

Some experts outline the challenges ahead. "The crucial question is if the high-energy inputs of gasification of biomass wastes are suitable and if the gasification process will technically work for the aimed feedstocks," says Achim Raschka, head of technology at the bio-based chemistry and industrial biotechnology department of the Nova Institute, a private biotech and chemistry research center in Cologne, Germany. "These questions will be addressed via an economical and ecological analysis of the whole process in the project."

Other experts still see the benefits of the approach. "It is a positive approach to get more out of organic fractions containing waste streams instead of incineration or landfilling," says Felicitas Schneider, engineer and researcher at the Institute for Waste Economics at the University for Natural Resources, in Vienna. Schneider concludes: "With respect to the [life cycle assessment] performance of bioplastics, this would have a positive impact on the production phase as if waste streams are used, no extra production of plants has to be taken into account."

It is still early days for the bioplastics sector. "Now, we are a very small industry, we have to grow", says Krysty-Barbara Lange, spokesperson for the European Bioplastics Association in Berlin, Germany, which gathers members of all industry sectors. Nowadays, food crops are the main source for first generation biopolymers. Second generation biopolymers are derived from other biomass resources such as wood or other plants. "We just grow a 0.01% of the global agriculture industry, but we need more options, and the Synpol project sounds very promising as a driver for a third generation of biopolymers," Lange tells CommNet. But there are still significant challenges ahead to make this approach economically feasible and environmentally sustainable, considers Lange.

If the project platform delivers on efficiency, the biopolymer's sector will take a significant step forward, though. "[The compounds] will be a 100% biodegradable", explains Oliver Drzyzga, who is project manager. He concludes: "now, we are working with [only] some grams of waste, but the aim is to make it economically sustainable, and build a big facility in Murcia [Spain]."

**More information:** phys.org/news313829339.html

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