

Beyond the bin: Giving biowaste a second life

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Coffee grounds collected from shops can be turned into food ingredients, biofuels and bioplastics. Credit: CC0 via Pixabay

Cities across Europe are working with researchers to turn organic waste such as coffee grounds into valuable goods.

It's hard to imagine a world without coffee given how many people

enjoy kick-starting their day with a freshly brewed cup.

Once the [coffee beans](#) are roasted and brewed, the leftover powder—coffee grounds—is often thrown away. Millions of tons of the powder end up every year in landfills, where its decomposition worsens the climate crisis by emitting methane.

Old matter, new goods

But coffee grounds can be recycled into a wide range of products. The [WaysTUP!](#) project is coming up with different ways to give coffee and other [organic waste](#) from European cities a second life.

"We are trying to open the gates for products that were unthinkable before," said Amadeo Semper, who works for SAV—Agricultores de la Vega, a Spanish waste-management company that coordinates the project.

Valencia-based SAV collects coffee grounds from local coffee shops, which sort the waste in a separate bin stockpiled along a "smart" collection route that prevents the material from rotting.

Through a series of chemical and extraction processes, the company then transforms this waste into a range of high-quality food ingredients. These includes carotenoids, which are natural pigments that can be used for their orange color, and polyphenols—antioxidants that can help protect against various diseases.

"Carotenoids are usually made synthetically, but we have developed a process to do this in a natural way," said Semper.

The four-year project, which ends in August this year, also works with 25 other partners to collect, process and refine more bio-based products.

Beans to bioplastics

Among the partners is a U.K.-based company called bio-bean, which turns coffee grounds into coffee oil or upscales it into high-value products such as barbecue charcoal, heating logs and natural flavors.

While bio-bean already had experience extracting coffee oil to make renewable biofuels, the EU's research funding allowed the company to expand to a new application: bioplastics.

"Coffee oil is an exciting area where we could deliver a clean technology and promote sustainability," said Ben Mills-Lampsey, [chief technology officer](#) at bio-bean.

Like SAV, bio-bean collects coffee grounds from large chains such as Costa and Starbucks, which store the waste in a separate container, and from factories that produce instant coffee.

With the help of urban waste-management companies, bio-bean receives tens of thousands of tons of coffee grounds every year. After the removal of anything that isn't coffee, the powder is dried and coffee oil is extracted.

Ultimately, the coffee oil is sent to other WaysTUP! partners. It is first fermented to create bio-degradable polyesters, which are then turned into bioplastic.

"There is nothing like waste," said Mills-Lampsey. "We should all change our minds towards that and use the resources that we have more efficiently."

Range of uses

Bio-bean is now extracting the coffee oil at a factory while creating other goods from used coffee that are sold commercially. Its dried coffee grounds product, "Inficaf," has a range of applications including in cars and in home, shop and restaurant interiors.

"It can be used in brake pads or to make kitchen cabinets," Mills-Lamprey said. "And most of the backgrounds at Costa or McDonald's are now made with spent [coffee grounds](#)."

But the potential of biowaste isn't limited to [coffee](#).

Back in Valencia, SAV also uses the leftovers from meat and fish to create new types of food.

It collects the fish and meat by-products from the city's Central Market, one of the biggest food markets in Europe. With the help of the municipality, it gives back value to hundreds of kilos of animal leftovers that would otherwise be costly to discard.

SAV developed a way to turn fish waste into collagen, a protein used both to feed animals and to make food such as jelly desserts as well as pharmaceutical pills. It also found a way to reuse animal blood from slaughterhouses as a component in bio-fertilizers.

Network of cities

"The range of products and applications that we can get from urban biowaste is huge," said Martin Soriano, an environmental scientist at CETENMA, a private non-profit technology center in Spain.

The products span proteins for food and animal feed, compost, bio-fertilizers, construction materials and cosmetics ingredients.

Soriano is using his academic background in biowaste applications to manage [HOOP](#), a project that was inspired by WaysTUP! and other research initiatives in the field.

HOOP, which began in 2020 and runs through September 2024, is helping European cities and regions use technologies developed in those other initiatives to recycle biowaste into valuable products.

Soriano's team focuses on recovering solid biowaste and wastewater sludge in eight so-called lighthouse cities and regions in Finland, Germany, Greece, Italy, the Netherlands, Norway, Portugal and Spain. Coordinated by CETENMA, HOOP is building the legal, financial and technical expertise in these areas for biowaste investments.

HOOP also includes 44 other members committed to replicating the practices and the aim is to have a network of 100 cities and regions in total.

Recycling urban biowaste and wastewater on a large scale would reduce the strain on landfills, help tackle [global warming](#) and generate green jobs in urban areas.

Spreading the word

To promote the circular economy further, WaysTUP! and HOOP are speaking with people across Europe to increase their awareness and acceptance of bio-based products.

The message is being spread at public events, in interactive exhibitions, on regional television and radio and even at local food markets.

By sharing the results of their work, the two projects aim to highlight the safety and environmental benefits of bio-recycled products.

"The best way to convince consumers is to show them the benefits," said Mills-Lamprey of bio-bean.

More information:

- [WaysTUP!](#)
- [HOOP](#)

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