

## **Mock Popularization Written for ScienceDaily.com**

Title: New Biodegradable Plastic Can Be Composted Right at Home

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*Summary:* A team of scientists, led by Dr. Macro N. Allemann, developed a new bioplastic called TPU-FC1, made from thermoplastic polyurethane. Unlike traditional petroleum-based plastics, TPU-FC1 is non-toxic, 100% food safe, and biodegradable. In contrast, petroleum plastics photodegrade into microplastics. The scientists tested TPU-FC1 against ethylene vinyl acetate (EVA), a petroleum-based plastic common in products ranging from artificial florals to foam flip-flops. In compost conditions, the team observed a significant degradation of the TPU-FC1 compound over 200 days, while EVA remained largely unchanged. They also identified bacterial strains that consume TPU-FC1, suggesting its potential for biodegradation in various environments. TPU-FC1 shows promise as a versatile and environmentally friendly alternative to traditional plastics, particularly in applications where previous versions of TPU fell short.

### **A Bioplastic Made Without Petroleum**

Dr. Macro N. Alleman, along with Marissa Tessman, Jaysen Reindel, Gordon B.

Scofield, Payton Evans, Robert S. Pomeroy, Michael D. Burkart, Stephen P. Mayfield and Ryan Simkovsky created a bioplastic made from thermoplastic polyurethane, which they called TPU-FC1. This new plastic is non-toxic and 100% food safe. TPU is a bioplastic, meaning it's made by chaining tiny oxygen and hydrogen atoms together as opposed to non-biodegradable plastic made by processing petroleum. Right now, TPU is a durable plastic alternative, used in place of

everyday hard plastics such as phone cases or Tupperware containers. Currently, 400 million tons of plastic lay in American landfills. To put that into perspective, the Great Wall of China weighs 100 million tons, meaning America has four Great Walls of China composed of waste sitting in landfills.

### **Petroleum Plastics Degrade into Microplastics**

Scientists noted that traditional vinyl-acetates, like all petroleum plastics, photodegrade rather than biodegrade. This means that instead of decomposing naturally, they degrade in-organically by the ultraviolet component of solar radiation. However, the final stage of degradation is not organic matter, it is microplastics. Scientists hypothesized that TPU-FC1 would be completely biologically degradable with an end state of a nitrogenic mixture commonly found in compost.

### **TPU-FC1 Outperforms EVA in Home Compost Conditions**

The team pitted TPU-FC1 against ethylene vinyl-acetate (EVA) which is a plastic used in everyday items. If are wearing tennis shoes, ethylene vinyl-acetate is probably what the soles are made of. Head-to-head they ground up both plastics into tiny microplastics. To evaluate the biodegradability of each, they used a compost material called Brunner minimal media. The goal of this was to create an environment similar to home compost conditions. They kept the sample chambers at 45 C with an approximate 58% humidity for the entirety of the experiment to again, mirror home compost conditions. Both sample chambers were opened biweekly to mix the compost-plastic mixtures and to add water as needed.

Samples of each compost mixture were removed at day 0, 90, and 200. Day 90 observed a 68% decrease ( $4221 \pm 695$  particles per  $\frac{1}{2}$  gram to  $1352 \pm 196$ ) in TPU-FC1 particles, in contrast, EVA particle samples were not significantly different from day 0. Day 200 produced even better

results, as TPU-FC1 particles dropped to a 97% degradation rate ( $135 \pm 34$  per  $\frac{1}{2}$  gram). Per hypothesis, EVA particle counts remained unchanged at day 200. Additionally, the scientists identified two bacterial strains that relied on TPU-FC1 as their sole carbon source, *Rhodococcus* 16S and *Bacillus* BF8. Both bacteria strains are found abundantly in terrestrial environments, strongly suggesting that TPU-FC1 would likely biodegrade in environments other than compost.

### **Soil Bacteria Can Break Down TPU-FC1 Without Industrial Help**

TPU-FC1 is consequently given the earned title of fully biodegradable. Furthering the discussion, previous versions of TPU have been well-documented in water-proofing polyester materials like umbrellas or raincoats, however, these versions of TPU did not respond as well in compost materials and needed more industrial aid to biodegrade. TPU-FC1 is a viable substitute for previous, less resonant TPU materials. TPU-FC1's ability to decompose without industrial help and the findings regarding terrestrial bacteria are defining features that TPU-FC1 has the most diversely applicable potential for biodegradable plastic.

## Story Sources

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