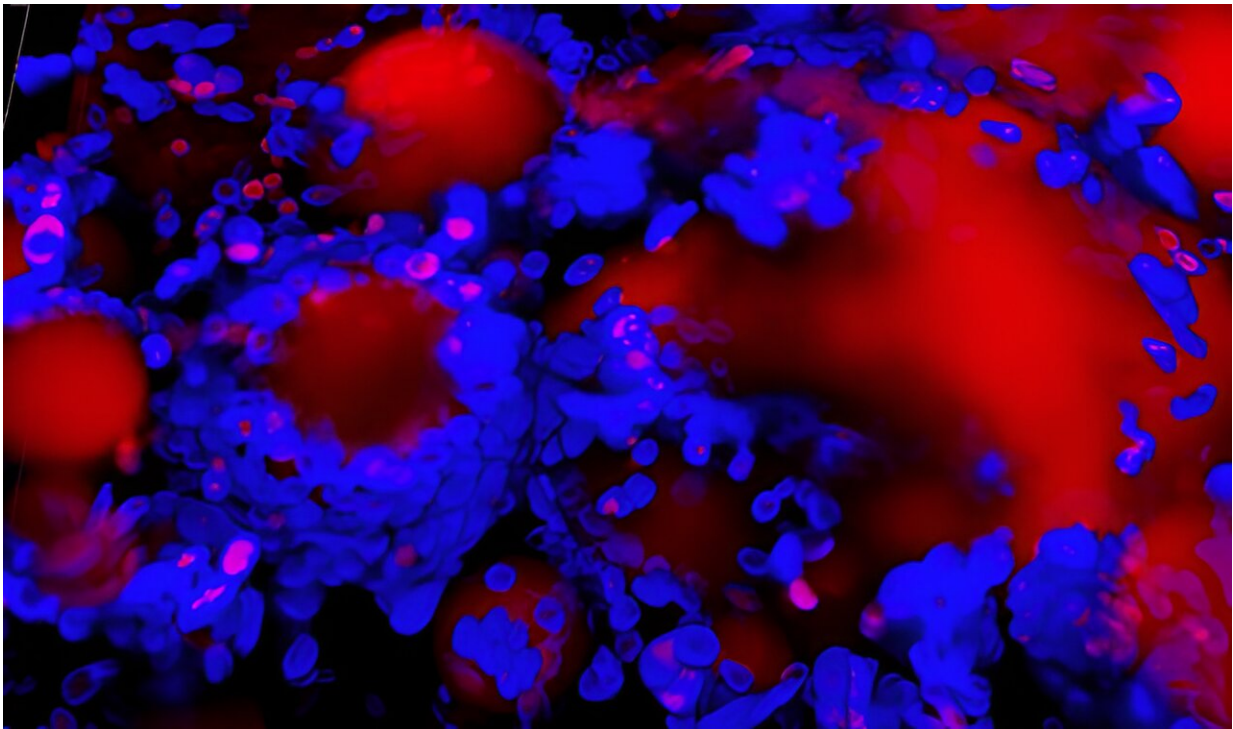


# Yeast uses plastic waste oils to make high-value chemicals

March 20 2024

---



Images of *Yarrowia lipolytica* surrounding and growing on polyolefin oil droplets (large red circles). Cells were stained blue to show the chitin cell walls and red to show the lipid bodies inside the cells and the oil droplets outside the cells. Credit: Cong T. Trinh

Polyolefins are a type of plastic that is resistant to breaking down. This makes this plastic—a kind found in everything from grocery bags to car

bumpers—hard to recycle. In a new study, scientists have discovered a potential solution, the yeast *Yarrowia lipolytica*.

The study found that the yeast can use hydrocarbons from polyolefin plastic wastes to grow its own cells. It does so by shifting its production of protein toward energy and [lipid metabolism](#) to grow on hydrocarbons. It can also produce [citric acid](#) and neutral lipids that can be used to make biodegradable polyesters and polyurethanes.

The paper is [published](#) in the journal *mSystems*.

Plastic wastes such as polyolefins are challenges for biological upcycling. This is the set of processes that use naturally occurring options such as microbes to break down and reuse plastics. This study discovered yeasts that can function as microbial catalysts for plastics. This would make yeasts a promising choice for sustainable processes for the biological upcycling of plastic [waste](#). The findings are a step toward decarbonization and reducing environmental pollution due to plastic consumption, incineration, and landfill storage.

The world needs sustainable processes for biological upcycling of plastic wastes in a circular bioeconomy to promote decarbonization and reduce environmental pollution due to plastic consumption, incineration, and landfill storage. This research used strain characterization and [proteomic analysis](#) to reveal the robust metabolic capabilities of *Y. lipolytica* for upcycling polyethylene into high-value chemicals.

When growing on hydrocarbons, *Y. lipolytica* partitioned into planktonic and oil-bound cells, each exhibiting distinct proteomes and amino acid distributions invested into establishing these proteomes. *Y. lipolytica* required significant proteome reallocation towards energy and lipid metabolisms for robust growth on hydrocarbons with n-hexadecane as the preferential substrate.

This growth included expression and upregulation of many associated proteins and pathways including the [hydrocarbon](#) degradation pathway, Krebs cycle, glyoxylate shunt, and unexpectedly, propionate metabolism. However, an apparent over-investment in these same categories to utilize complex depolymerized plastics oil came at the expense of protein biosynthesis, limiting [cell growth](#).

Overall, this study elucidates how *Y. lipolytica* activates its metabolism to utilize depolymerized plastics oil and establishes *Y. lipolytica* as a promising host for the upcycling of plastic wastes.

**More information:** Caleb Walker et al, Proteomes reveal metabolic capabilities of *Yarrowia lipolytica* for biological upcycling of polyethylene into high-value chemicals, *mSystems* (2023). [DOI: 10.1128/msystems.00741-23](#)

Provided by US Department of Energy

Citation: Yeast uses plastic waste oils to make high-value chemicals (2024, March 20) retrieved 27 April 2024 from <https://phys.org/news/2024-03-yeast-plastic-oils-high-chemicals.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.