Lowering carbon with recycled plastic

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September 5, 2025

Chemists at the University of Copenhagen have developed a way to use recycled plastic to trap carbon dioxide from industrial emissions. It is a win-win scenario, with the technology promising to reduce earth-warming industrial waste by using the unwanted and unhealthy plastic that pollutes our landfills, rivers and oceans.

The group published their report in Science Advances in September 2025 1. The technology hinges on the ability to upcycle commonly available PET plastics into a new material the team has named BAETA. This new compound has an insatiable appetite for carbon dioxide. Senior author Dr Margarita Poderyte says, “If we can get our hands on the highly decomposed PET plastic floating in the world’s oceans, it will be a valuable resource for us as it’s so well suited for upcycling with our method.”

The plastic problem ...

Polyethylene terephthalate, or PET plastics, are used in the manufacture of plastic bottles and other food containers. It is also in demand in the clothing industry, where it is spun into polyester fibres. Only a small percentage of PET plastic is currently recycled into everyday items such as carpets and shipping materials. The rest ends up in our water supply, eventually polluting our oceans. Once broken down into microplastics, they are consumed by marine invertebrates and the fish that prey on them, where they make their way back up the food chain to humans. Microplastics are bad news - having been implicated in inflammation in our bodies and disrupting our immune systems.

The good news ...

The new technique involves breaking PET plastic down into its simplest chemical building blocks. Ethylene diamine, the magic ingredient, is added, which gives the new compound, BAETA, the ability to absorb carbon dioxide from the air. The process is economical, energy-efficient, performed at room temperature, and uses a mild chemical treatment method.

The advantages do not end there. The technique is scalable to a degree and works well with low-quality plastics, including microplastics harvested from the ocean. Associate Professor Jiwoong Lee, co-author of the study, explains, “One of the impressive things about this material is that it stays effective for a long time, and it can tolerate high temperatures. That flexibility makes it realistic for industrial deployment.” The BAETA compound itself, once at maximum capacity, can be reused and recycled, with its carbon dioxide payload being captured for later use.

Future work ...

The challenges of using BAETA are very practical ones. Microplastic pollution is everywhere, and it is getting worse. Immediate priorities include the efficient harvesting of the “resource” and scaling the technique to industrial levels to trap several tonnes of carbon dioxide at multiple locations around the world.

Nevertheless, if the practical issues can be overcome, Dr Poderyte anticipates it could be put into use within a matter of years, rather than decades. For example she foresees an immediate application of fitting the BAETA reactors onto the end-of-pipe chemical processes before its carbon dioxide emissions exhaust into the atmosphere. The recovered carbon dioxide can be repurposed into feedstocks and other industrial processes providing a new income stream for businesses that invest in the technology.

A cooler earth, reduced pollution and better health from one product is surely a win for all.

Reference

Poderyte et al. Repurposing polyethylene terephthalate plastic waste to capture carbon dioxide. Sci. Adv.11, eadv5906 (2025).