

# Microwaves could turn plastic waste into hydrogen fuel

Tom Whipple, Science Editor

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Previous work looking at releasing hydrogen from plastics has proven costly but a British team of scientists believe their system would be a cheaper solution. MARCUS ERIKSEN/SYGMA/ISTOCK

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From the yellowed bottles in landfill to the jellyfish-like bags clogging the oceans, plastics pollution is an apparently intractable problem.

Yet, chemists lament, it shouldn't be. Within this waste there is something extremely useful, if only we could access it: hydrogen. Now a British team of scientists believes it has found a way to get at it, and do so cheaply, thanks to tiny particles of iron and microwaves.

If their system works at scale they hope it could be a way of cheaply converting useless plastic into hydrogen fuel and carbon.



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Peter Edwards, from the University of Oxford, said the research pointed a way to dealing with a big environmental issue. "Some people may deny the climate change problem, but no one denies the plastics problem," he said. "It's there right in front of your eyes."

He and his colleagues, whose work is outlined in the journal *Nature Catalysis*, are not the first to think of liberating hydrogen, or of finding ways to break down plastics into useful materials.

Yesterday, plans were [announced](#) to build recycling plants in the UK that had the capacity to convert 130,000 tonnes of plastic a year into

the “monomer” building blocks that can be used to create new plastics.

Professor Edwards said that previous work, in particular looking at releasing hydrogen, has always proven costly. “There are ways of doing it, but it’s quite messy,” he said. “The challenge has always been, how the hell do we get it out cleanly?”

The clue came in research on particles of iron, and what happens when they get really small. “There’s a fascinating problem,” Professor Edwards said. “You take a bit of metal, and you break it into smaller and smaller bits. At what stage does it stop behaving like a copy of the bigger bit?”

When the particle gets below a critical size, it turns out it’s no longer a metal in the standard sense. The electrical conductivity plummets, and its ability to absorb microwaves does the reverse, increasing by ten orders of magnitude.

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Professor Edwards realised that this could be useful. “When you turn on the microwaves, these things become little hotspots of heat,” he said. When he put them in a mix of milled-up plastic, he found that they broke the bonds between the hydrogen and carbon, without the expense and mess of also heating up the plastic itself.

What is left is hydrogen gas, which can be used for fuel, and lumps of carbon nanotubes, which Professor Edwards hopes might be of a high enough grade to have a use as well. The next stage is to work with industry to find ways to scale it up.

Alison Parkin, from the University of York, said that even if the carbon made by the process proved useless, it was still a big improvement on the alternative.

“This is an interesting study that showcases how sustainable chemical approaches might help us tackle the problem of plastic waste,” she said.

“Hydrogen is a useful product and even if the carbon nanotubes are just a new form of fancy coal, it is far more environmentally friendly than releasing the equivalent amount of CO<sub>2</sub> gas.”

Professor Edwards said the research, based on work into the properties of metals, also showed the value of curiosity-driven research. “Who would have imagined that the physics of turning a metal into an insulator — by the Nobel laureate Sir Nevill Mott — would form the basis of chemistry helping the global plastic waste challenge?”

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