



The bitter truth about chemical recycling

In today's industrialized world, plastic is everywhere. At supermarkets, food and household items are usually packaged in plastic bottles, tubs and packaging. When you order something online, your product may arrive shrink-wrapped in plastic. Not only that, but plastic is often part or all of the product itself, be it kids' toys, holiday decorations or one of our ubiquitous electronic devices.

Is chemical recycling the way to deal with plastic waste?

The world is desperately in need of effective plastic solutions. According to the United Nations Environment Program, about 430 million metric tons of plastic are produced per year. Most of this plastic is used only briefly and then discarded, often improperly. An estimated 2,000 garbage trucks full of plastic are dumped into the world's oceans, lakes and rivers every day. The problem is set to get far worse. If the plastics industry is permitted to continue growing without significant regulation, plastic production may nearly triple in the next 40 years, from about 460 million metric tons in 2019 to 1.23 billion metric tons by 2060.

The planet has already become so inundated with pollution from plastics and other synthetic chemicals that scientists say we've breached a critical "boundary". This assertion is based on the planetary boundaries theory, which argues that Earth has nine key operating systems that enable life to thrive. However, each of these systems has a boundary threshold - or thresholds - that, if crossed, can destabilize Earth's "safe operating space". Plastic pollution is considered part of the "novel entities" boundary, and scientists say that this one, along with five other boundaries, including climate change and biosphere integrity, has been crossed.

Plastic producers and fossil fuel companies argue that chemical recycling presents a solution to the world's plastic problem since it is intended to process plastics that can't traditionally be recycled, keeping them out of the environment. Many plastic products are marked with seemingly helpful recycling symbols, leading consumers to believe that most, if not all, plastic can be recycled. But that's not the case. Traditional recycling - the process of breaking down, melting and remolding plastic to form new products - is expensive, time-consuming and limited to certain plastic types. In the US, for example, only types 1 and 2 are easily recyclable, while 3 through 7 aren't. Recycling rates are also historically low; in the US, it's estimated that only 5 - 6% of plastic is recycled.

There's another way to deal with plastic waste, it is called "chemical recycling", or "advanced recycling" an industrial process that the industry claims could recycle more types of plastics and help humanity transition to a circular economy. However, according to a recent report released by Swedish nonprofit International

Pollutants Elimination Network (IPEN) and US - based NGO Beyond Plastics, most chemical recycling claims have yet to be proven, while existing chemical recycling facilities are exacerbating the pollution problem.

The IPEN and Beyond Plastics report suggests that chemical recycling is not really recycling at all. Instead, it's an umbrella term for a range of technologies that use heat or chemicals (or both) to break down the polymer chains in plastic waste to create "output". Two main chemical recycling processes are in use today: Pyrolysis, which heats waste without oxygen at very high temperatures; and gasification, the heating of waste in a low - oxygen environment. In most cases, the output is fuel, although chemical recycling can also generate feedstock for new plastic products, according to the petrochemical industry.

However, the report shows that most chemical recycling facilities in operation today produce very little usable plastic feedstock despite creating no shortage of hazardous waste that damages the environment and threatens human health and safety. The petrochemical industry says that "chemical recycling" processes can recycle more types of plastics and help humanity transition to a circular economy. However, Mr. Lee Bell, the report's lead author and IPEN's policy advisor for persistent organic pollutants (POPs) disputed these claims: "We're seeing this technology hyped by the plastics industry as a solution to the plastic crisis, and it's no such thing. Simultaneously, chemical recycling is a "risky" business".

According to research that authors reference, chemical recycling processes create large amounts of toxic waste and toxic emissions that can cause significant human health problems, while the facilities themselves have been prone to fires and explosions. Additionally, they say that the greenhouse gas emissions from chemical recycling processes contributes to the acceleration of climate change. Far from offering a solution, these processes can "create as much as 100 times more damaging environmental and climate impacts than virgin plastic production", which seriously calls into question the efficiency and environmental benefit of chemical recycling.



But Mr. Ross Eisenberg, the President of America's Plastic Makers, an arm of the American Chemistry Council (ACC), a plastic industry association based in Washington, D.C., takes a different view. He argues that chemical recycling activities are strictly monitored and provide a way to "build a more sustainable and lower carbon future". Mr. Ross Eisenberg also referenced a study conducted by the Argonne National Laboratory, a US Government-funded research and development center in Illinois, that found that chemical recycling engaged in pyrolysis oil production generated an 18% to 23% decrease in greenhouse gas emissions and also decreased fossil energy use, water use and solid waste.

However, as Mr. Lee Bell explained that, this particular study relies on industry data and doesn't "address or characterize the toxicity of solid waste, atmospheric emissions or other hazardous releases from the pyrolysis process". He said the Argonne study also doesn't note that pyrolysis oil is usually loaded with contaminants, making it "unsuitable" for plastic production and refineries, and that it requires dilution with virgin petrochemicals, which makes the pyrolysis process "neither sustainable nor circular".

A closer look at chemical recycling facilities' databases in the world

While investors have already spent billions of dollars to develop chemical recycling, the industry is not yet fully fledged. For example, the chemical industry trade group American Chemistry Council (ACC) is advocating for the establishment of more than 150 new plants across the US, but at present, there are only 11 constructed facilities in the country. Among them, four operate at a pilot or demonstration scale, and four others are partially operational. IPEN and Beyond Plastics analyzed company records, news sources and other information to provide details about these US's facilities in their report. At least seven of the facilities were found not to be operating at capacity or delivering what they had promised, with aims and goals still unmet and unproven.

In addition, the report notes that a Brightmark Energy facility in Ashley, Indiana, predicted in June 2020 that it would "reach a yearly plastic waste recycling capacity of 100,000 tons by early 2021", and the operation received US\$ 4 million in US Federal subsidies to help make this happen. However, to date, the plant has only processed about 2,000 tons of plastic waste, while it has been impacted by fires, oil spills and worker health and safety complaints. For the remaining four facilities, there is a paucity of publicly available information about their capacities and output.

Among them, Chevron intends to build a chemical recycling facility to turn waste plastic via pyrolysis into oil that can be refined into jet fuel. However, the US Environmental Protection Agency found that the project had a public risk factor of 1 in 4 - a level 250,000 times greater than what is typically permitted. "This means that 25% of the local population would likely develop

cancer in their lifetime as a result of exposure to the facility's emissions", the report's authors write. Other potential plastics - to - fuel products connected to this proposed plant had even greater risks associated with them.

Chemical recycling plants aren't only popping up in the United States. There are already plants in the U.K. and several other countries in Europe, including Denmark, Netherlands, Germany, France, Belgium, Spain and Poland.

The concerns regarding air pollution and contamination from these facilities are essentially the same for chemical recycling plants on both continents.

The challenge with plastics is huge. So we know we need lots of different solutions here. It's clear that chemical recycling is one of the issues that we are going to have to deal with plastic pollution. Chemical recycling - or what the industry likes to call "advanced recycling" - is increasingly touted as a solution to the plastic waste problem, but a landmark new report from Beyond Plastics and IPEN shows this technology hasn't worked for decades, it's still failing, and it threatens the environment, the climate, human health, and environmental justice. This report clearly shows that chemical recycling's lack of viability, and its harms so that others, especially lawmakers and regulators, can see this pseudo-solution for what it is.

Mr. Lee Bell said he believes one reason chemical recycling has been able to progress without strong opposition and close scrutiny is because companies are not releasing adequate data, especially in relation to their toxic emissions and hazardous waste streams. This lack of data and transparency can pose a problem for environmental regulators, policymakers and even investors who are enabling the rise of this industry, he said. At the same time, Mr. Lee Bell believes policymakers are now becoming more aware of the risks associated with chemical recycling. He noted that the petrochemical industry "could not demonstrate that it's environmentally sound as a technique for managing plastic waste. And it was not agreed to include it in the global plastic waste treatment guidelines. It remains to be seen whether chemical recycling will be included in the global plastics treaty" ■

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