Luxurious, sustainable fragrances: Gucci develops perfume made from carbon monoxide waste from metal factories

What if microbes could transform the pollution and stench of industrial waste into luxurious, sustainable fragrance?

It sounds like alchemy. But thanks to LanzaTech's carbon-captured ethanol, 100% derived from the carbon monoxide waste of metal factories, you can wear it today.

The perfume, called Where My Heart Beats, was developed by Coty for Gucci's The Alchemist's Garden Collection. Floral aromas of peony and violet are a far cry from its smokestack origins.

It's a whiff of the net zero future I'm excited to hear about from LanzaTech's CEO Jennifer Holmgren at this year's SynBioBeta conference.

Climate change is already having "widespread adverse impacts" that will only continue to intensify if we don't rapidly slash greenhouse gas emissions to net zero.

Amongst swathes of critical changes that are required, the report cites carbon capture technology as one way to help get us there.

A lot of companies – big oil amongst them – are looking into it. However, critics say that this merely puts a green sheen on the status quo, whilst fossil fuels continue to be extracted in earnest.

But LanzaTech says we have enough carbon above ground to make everything we need.

Carbon needn't come from oil and natural gas. Instead, we can recycle it.

Meet LanzaTech's carbon-crunching bacteria

A lot of industrial processes produce carbon monoxide gas as a waste product. Metal manufacturing, mining and food production to name a few.

LanzaTech uses a particular microbe, *Clostridium autoethanogenum*, which thrives on carbon monoxide gas and converts it into ethanol. Pure alcohol.

Already running three large facilities, and with demonstration sites and more set to open this year, LanzaTech works with global partners to produce carbon-captured ethanol on an industrial scale.

"Our microbes selectively pull out the carbon molecules found in emissions and pollution and transform

those carbon molecules into ethanol," Holmgren explains. "What was once pollution is regenerated into a molecule ready to enter numerous value chains, such as conversion into polyester or jet fuel.

"In the case of perfume, ethanol itself is formulated with fragrance oils to improve consistency and speed up evaporation when applied to the skin."

Coty and Gucci's perfume is a recent addition to a large portfolio of applications. Hot on the trail was H&M, who just brought out a new collection of workout wear made using LanzaTech ethanol-derived polyester.

It's a timely intervention, considering the fashion industry contributes a huge 10% of greenhouse gas emissions.

LanzaTech's ethanol, produced using a closed loop continuous process that recycles water, also offsets the water that would normally be used in its traditional manufacture for use in perfumes.

So now you can keep fit and smell amazing afterwards, all while doing a little bit for carbon neutrality and sustainability.

Waste not, want not

LanzaTech is amongst a growing ecosystem of carbon recycling companies.

Air Company and Twelve, for example, use electrolysis to convert carbon dioxide into useful chemicals normally derived from oil.

Then there's Newlight, which converts landfill methane into a liquid product that is then fed to microbes that produce PHB – a natural polymer that can be used to make biodegradable plastics.

Credit: Pxfuel (Public Domain)

They all see what carbon recycling is worth, tapping into markets with a combined value of over a trillion dollars.

LanzaTech's ethanol alone addresses an $85 billion market. Its spin-off LanzaJet uses the ethanol to produce sustainable aviation fuel (SAF), which first took flight on a Virgin Atlantic plane in 2018, eating into a growing market over twice that value.

"I believe sustainable aviation fuel is a key lever for lowering the carbon footprint of air travel," says Holmgren. "SAF can be used with existing commercial planes, so this drop-in does not require an entire system redesign in order to reduce air travel's climate impact."

LanzaJet's Freedom Pines Fuels facility in Soperton, Georgia, is set to be completed this year and will double US production of SAF. It will soon be joined in India, where LanzaJet will produce cleaner aviation fuel at Indian Oil's Panipat refinery.

Flexible and scalable

Whilst it's difficult in the short term for carbon recycling to compete with the sheer scale of the petrochemical industry, there's huge value in LanzaTech's modularity.

The company's template can be adapted to various types of carbon waste. Whatever the feedstock – be it industrial waste or biomass – the same bioreactor can be used, right at the source.

Furthermore, thanks to synthetic biology and a new generation of LanzaTech microbes, solvents such as isopropanol and acetone are being added to the portfolio of useful chemicals and materials that can be produced.

"We are doubling down on the commercial deployment of our technology," says Holmgren. "We have three commercial plants in operation and another three anticipated to come online before the end of the year.

"The more facilities we can build, the greater our capacity to capture carbon emissions and meet the scale needed to decarbonize some of the hardest-to-abate industries."

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