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ROLE FOR BACTERIA IN CLIMATE FIGHT

Start-ups look to boost production after pilot plants show microorganisms can recycle carbon gases

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Technology that uses microorganisms to turn carbon emissions into raw materials is edging closer to commercialisation as production is scaled up to cut costs, industry experts said.

Some start-ups have demonstrated the viability of their technology through pilot plants by reducing the use of virgin fossil fuel resources to produce fuels and industrial materials.

Chicago-based LanzaTech is one of them. It has developed technology that uses bacteria to convert carbon monoxide into ethanol. Ethanol can be blended with petrol for use as motor fuel or as a feedstock for making chemicals with applications from garments to packaging.

“We are not just trying to decarbonise industry, brands and their products, we are [saying] there is already enough carbon above the ground [that we] can use to make things for our daily lives that normally come from fossil carbon,” CEO Jennifer Holmgren said. The initiative is part of the push by the US and Chinese governments, which agreed in April last year, to jointly undertake efforts to address the global climate crisis.

The two major carbon emitters said they would promote “circular economy” activities that involved the reutilisation of renewable resources, one of the five key areas of cooperation.

After 14 years of research, LanzaTech has helped partner Shougang Group build two bioreactors to make ethanol from gases emitted by the Beijing-based steel maker’s facilities.

LanzaTech’s “gas fermentation” technology is similar to brewing. Instead of using yeast that eats sugar to make alcohol, it uses a bacteria to “eat” waste carbon to make ethanol. Another 14 LanzaTech facilities financed by other partners with a total capacity to capture 1 million tonnes of carbon gases annually in the United States, India, Canada, Europe, South Africa and Australia are in various stages of engineering and construction. Costing US\$50 million to US\$100 million each, they turned carbon gases extracted from industrial, municipal and agricultural wastes into ethanol, Holmgren said. Such recycled materials have found their ways in small quantities in apparel, food packaging and perfume.

The potential market is huge, as the global chemical industry accounts for 3.3 billion tonnes of greenhouse gas emissions annually, or 6.6 per cent of the world’s total, according to chemicals and energy data provider ICIS.

California start-up Newlight Technologies uses methane and carbon dioxide-eating microorganisms to make a “carbonnegative” biodegradable material called polyhydroxybutyrate to replace plastic and leather. Last month, it launched a coating for moisture- and grease-resistant paper products such as coffee cups and takeaway containers. British-based Eonic Technologies and German chemicals firm Covestro have developed novel catalysts to make plastic products through processes where waste carbon dioxide replaces part of the fossil fuel-based feedstock.

Since production began in May 2018, LanzaTech has produced nearly a million tonnes of ethanol, preventing 130,000 tonnes of carbon emissions.

It had raised more than US\$500 million since its inception, Holmgren said. Shareholders include steel titans ArcelorMittal and China Baowu Steel Group, chemicals giants BASF and China Petrochemical Corp, investment banking firm China International Capital Corp and Chinese conglomerate Citic.

LanzaTech has nearly 1,100 patents and 475 pending applications globally related to its fermentation processes. Still, viability questions such as financial and other barriers to commercialisation needed to be addressed, British-based market research firm IDTechEx said.

“Not all carbon dioxide utilisation pathways are equally beneficial to climate goals and not all will be economically scalable,” it said.

There is already enough carbon above the ground ... to make things for our daily lives
JENNIFER HOLMGREN, LANZATECH C.E.O.