

Enabling a Circular Economy: Low Carbon Fuel and Chemical Production from Waste

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Abstract:

The climate crisis is the most urgent challenge to mankind which can only be resolved via rapid action to drastically reduce waste carbon emissions. Carbon recycling technologies can transform above-ground carbon sources into sustainable fuel and chemical products. These technologies offer an industrial approach to both enable fuel and chemical manufacturing at its current scale, and achieve sustainability targets. Gas fermentation using carbon-fixing microorganisms is a fully commercial carbon recycling process technology that transforms waste carbon resources into sustainable fuels, chemicals and polymers at a scale that can be truly impactful in mitigating the climate crisis. LanzaTech is a pioneer and world leader in gas fermentation, having successfully scaled up the process from the laboratory bench to full commercial scale, with several commercial plants in operation and many additional facilities in construction.

Compared to other gas-to-liquid processes, gas fermentation offers unique feedstock and product flexibility. The process can handle a diverse range of high volume, low-cost feedstocks. These include industrial emissions (e.g., steel mills, processing plants or refineries) or syngas generated from any resource (e.g., unsorted and non-recyclable municipal solid waste, agricultural waste, or organic industrial waste), as well as CO₂ with green hydrogen. In the first instance there LanzaTech process is focused on the direct production of ethanol from these sustainable feedstocks. This ethanol can either be used directly as a blend stock in gasoline or dehydrated to ethylene for the manufacture of everything from sustainable aviation fuel to polyester resins, and surfactants.

Additionally, LanzaTech has developed a comprehensive synthetic biology capability for gas fermenting bacteria. This capability has enabled the company to demonstrate and, in some cases, scale the direct production of over 100 alternative chemical outputs from its gas fermentation process. **One such molecule is ethylene**, the most widely used petrochemical in the world with a \$125Bn market. LanzaTech is pioneering the direct production of sustainable ethylene having already demonstrated continuous ethylene synthesis from CO₂ in its laboratory.