Valuable liquid fuels from waste gas

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Velocys, an Oxford Chemistry spin-out company, markets smaller-scale reactors and associated catalysts that are able to convert low-value and waste gas or municipal waste into high-grade liquid hydrocarbon fuels

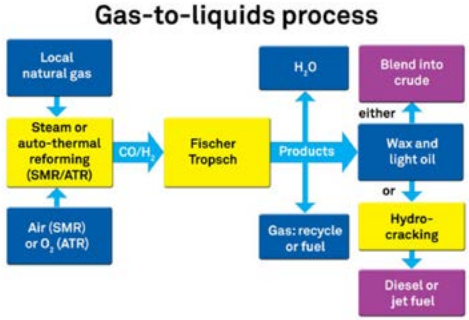
A new application of a little-known chemical process has enabled Velocys, a University of Oxford spin-out company, to secure orders worth millions of dollars for its smaller-scale reactors and associated catalysts that are able to convert low-value and waste gas or municipal waste into high-grade liquid hydrocarbon fuels.

Velocys' technology uses the Fischer-Tropsch process, chemical reactions that convert a mixture of carbon monoxide and hydrogen ('synthesis gas' or syngas) into liquid fuels. The process was developed in Germany in the 1920s, and in the last decade or so concern about diminishing oil supplies and a desire to make use of wasted gas resources has led to a renewed interest in Fischer-Tropsch catalysis.

Velocys microchannel reactor – small enough to fit in a standard shipping container

The Fischer-Tropsch Process

Gas produced during oil production is frequently disposed of by flaring (burning); 140 billion cubic meters of associated gas – enough to power Germany – was flared globally in 2011. 'Stranded' gas in remote locations often remains undeveloped because it is not economically viable to pipe the gas to where it is needed. Biomass feedstock is an excellent source of syngas, but again it is not economic to transport biomass over long distances to centralised production facilities. In all these cases a solution is needed that can make use of the undervalued or wasted resource in situ.



Companies such as Shell have built highly-profitable gas-to-liquids plants incorporating conventional Fischer-Tropsch technology, but they are huge, require vast sources of gas, and cannot be scaled down economically. They also cost billions of dollars to build.

Now Velocys (formerly Oxford Catalysts) has worked out a way to make 'microchannel reactors' that are small enough to be transported in standard-size shipping containers. The price tag and transportability of the technology means that it is accessible to more companies in more locations, enabling on-site production of liquid fuels from gas that might well otherwise be flared or lie unused, as well as from biomass.

The technology is underpinned by nearly two decades of research led by Professor Malcolm Green at the Wolfson Catalysis Centre. Building on his serendipitous discovery that a ruthenium oxide catalyst was capable of converting 90% of methane into syngas, Green explored a range of catalysts that might have commercial potential.

Catalyst development at Milton Park, Oxfordshire

The breakthrough came in the development of cheaper carbide catalysts which had the key features needed for the microchannel reactors subsequently developed by Velocys: they showed no deposition of carbon (which can 'kill' a catalyst and render it useless), they were highly active and stable, and they were effective not only for producing syngas but also for the subsequent stage in the Fischer-Tropsch process – the conversion of syngas into high-grade hydrocarbons.

In 2010 the company demonstrated its technology at a small biomass-to-liquids plant in Güssing, Austria. The company has now been selected for four commercial-scale projects, including one being developed by Solena Fuels in partnership with British Airways.

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The GreenSky London waste-biomass to jet fuel plant will produce 50,000 tonnes of jet fuel annually over 10 years, equating to $500m at today's prices: more than twice BA's fuel requirements for London City Airport. The potential of this technology has generated a high level of investment in Velocys (£52 million was raised in a fund-raising round in September 2014) and demand for their technology looks set to increase.

Images courtesy of Velocys.

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