The number of biocrude projects has increased rapidly over recent months as petroleum companies seek to integrate biomass into existing petrol infrastructure

BTL biocrude

FEEDSTOCKS	ORGANISATIONS	FUELS
Biocrude for air transport fuels		
Chicken fat	Syntroleum	Jet fuel for military
Algae	UOP/DARPA, Chevron/NREL LiveFuels/Sandia, Shell/HR	Jet fuel for military
Jatropha	Air New Zealand	Jet fuel for commercial air
Biocrude for Vehicle transport fuels		
Switchgrass, corn cobs	ADM/Conoco, Iowa State	Ethanol, diesel
Yellow grease	Conoco, Syntroleum	Renewable diesel
Chicken fat	Tyson, Conoco, NovaSource	Renewable diesel
Wood chips	Shell/Choren	Green diesel for cars
Sewage and algae	Aquaflow Bionomic Corp	Ethanol, diesel
Algae	Algenol	Ethanol
Biocrude for power generation		
Soy hulls, algae	Sustainable Power Corp	Power generation
Wood chips	Dynamotive	Power generation
Plastic bottles, rubber Tyres, garbage, sewage	Changing World Technologies	Power generation

Source: Emerging Markets Online, Biodiesel 2020: A Global Market Survey

Biocrude is becoming one of the leading next-generation technologies as it can efficiently use any type of biomass including waste streams and waste from dedicated energy crops thereby overcoming problems related to food versus fuel issues.

For petroleum companies, when comparing first generation biofuel processes via biochemical conversion for ethanol (fermentation, distillation) and biodiesel (trans-esterification), the process of making biocrude via thermochemical conversion (using heat) offers several advantages.

The first is that it can effectively use the existing refining and distribution systems of the petroleum industry, making biocrude a preferred pathway for biofuels among the major oil companies. Conoco, Shell and Chevron have started biocrude development in various R&D projects, pilot plants, and first-stage commercial operations. There are several other companies pursuing the biomass to biocrude pathway to biofuels, including UOP, Syntroleum, Sustainable Power Corp, LS9, NesteOil, Dynamotive, Ensyn, and the LiveFuels algae to biocrude consortium.

Biocrude technologies

Another name commonly used to refer to biocrude is pyrolysis oil, derived from pyrolysis – the most popular thermochemical method of creating biofuel from biomass. Pyrolysis oil is one of the products gained when biomass feedstocks (including grease, municipal waste, switchgrass and algae), are put in a container and processed using heat, but without oxygen. Fast pyrolysis is a process that rapidly heats biomass in the absence of air at 450-600°C. The end product is biocrude, also known as pyrolysis oil or bio-oil.

Fast-pyrolysis can yield around 70% of bio-oil from a given biomass feedstock, along with solids (char at 15-20%) and a small amount of gases. The pyrolysis liquid can then be further refined into a range of transportation fuels and green chemicals in dedicated biorefineries or in existing petroleum refineries. It is this liquid that is showing promise for conversion into various states of transportation fuels, including jet fuel, biodiesel, ethanol and hydrogen.

Other thermochemical processes used to create biocrude include the Fischer-Tropsch gas-to-liquids (GTL) method to gasify biomass and then refine the gases into compatible forms of jet fuel, diesel, heating oil, and bio-ethanol. Another method is called thermal depolymerisation, which also uses heat to decompose biomass and break long molecular chains (or polymers) into smaller molecules in a GTL process.

BTL biocrude to ethanol

In 2007, ConocoPhillips and Archer Daniels Midland agreed to collaborate on the development of renewable transportation fuels from biomass. The alliance will research and seek to commercialise two components of a next-generation biofuel production process: the conversion of biomass from crops, wood or switchgrass into biocrude (pyrolysis oil, bio-oil) that can be processed into fuel; and the refining of biocrude to produce transportation fuel.

ConocoPhillips has also funded a $22.5 million (€14.4 million) research project at Iowa State University to develop a biomass-to-ethanol system that takes plant biomass such as corn stalks and switchgrass, decomposes the plant material by fast pyrolysis to convert biomass into a biocrude. The biocrude would then be gasified with steam and/or oxygen to produce a synthesis gas

that can then be refined with a nanotechnology-based catalyst to produce ethanol fuel.

Biocrude from waste to green/renewable diesel

In Germany, Shell Oil and Choren are using another form of biomass – woodchips – to create Green Diesel via biocrude. Choren's first major plant will start commercial-scale production in 2008 using around 65,000 tonnes of wood and wood chips as raw material annually. Choren's production is planned to be largely blended with fossil diesel.

There are several renewable diesel plants now emerging to process biomass (chicken fat, grease, wood chips, other biomass) into biocrude, and then refine the biocrude into a diesel fuel equivalent. This group includes Dynamic Fuels, a joint venture between Tyson foods and Syntroleum, to produce 85 million gallons of renewable diesel using chicken fat and trap grease. Sanimax, the largest renderer and processor of yellow grease and animal by-products in the US, already operates a 20mgy facility and has announced plans to build more plants. NovaSource biofuels is another emerging player in the biocrude to transport fuels market with a planned capacity of over 200 million gallons per year.

Biocrude from algae

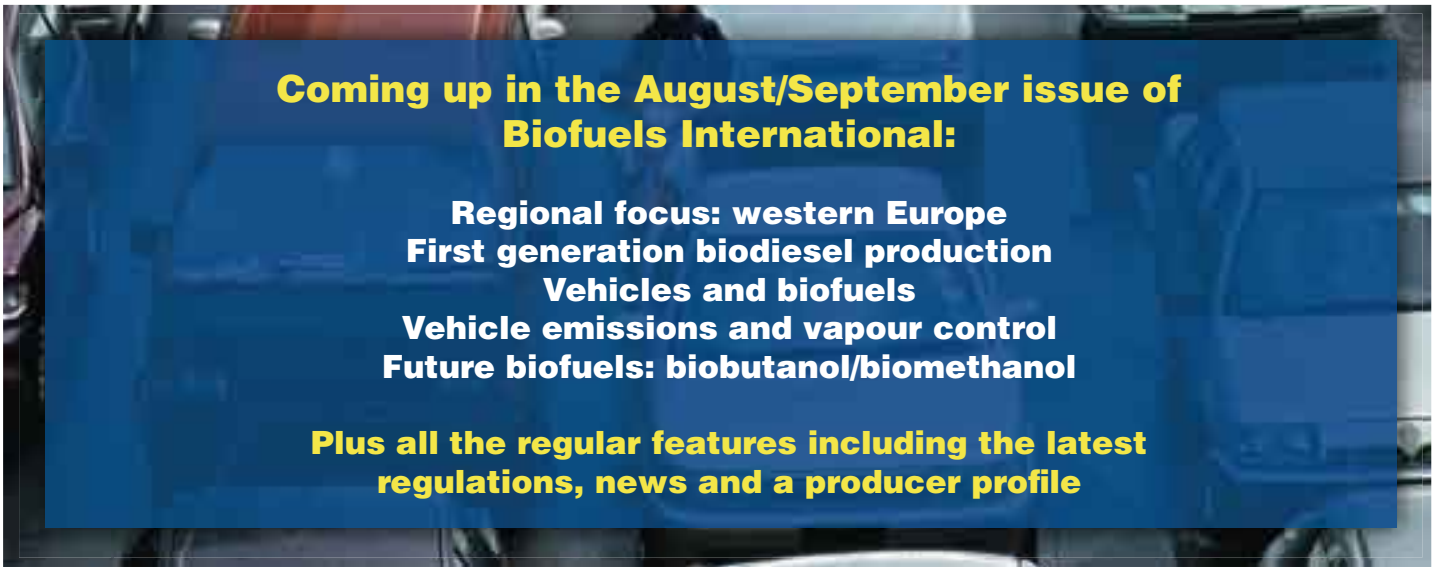
Looking towards the future, some of the largest petroleum and petrochemical companies see algae as a key pathway towards creating transport fuels using BTL biomass to liquids via biocrude. These petroleum companies are also working in public-private partnerships (PPPs) with the US Departments of Defense and Energy and several large-scale national research laboratories to create jet fuel and transportation fuels from algae.

These laboratory-petrol PPP partnerships to create biocrude from algae include: DARPA – the Defense Advanced Research Projects Agency and UOP/Honeywell; the National Renewable Energy Laboratory and Chevron; the Natural Energy Laboratory of Hawaii/Shell/HR Biopetroleum; and the University of Arizona/British Petroleum. Sandia Labs, in collaboration with the US Department of Energy and Live Fuels, has created a mini Manhattan Project to turn algae into biocrude for multiple fuels: jet fuel, ethanol, biodiesel and hydrogen.

Many of these projects seek to sequester carbon from coal-fired power plants to grow algae for transport fuels. Scientists at Sandia Labs estimate algae-based biocrude could produce the US' entire transport fuels supply using only 15,000 square miles of desert land.

Biocrude provides one solution to several of the problems surrounding today's biofuels by using waste (grease, sewage, carbon dioxide emissions, wood chips, agricultural waste) instead of food, and without compromising arable land or rainforests in the process. Biocrude systems also help to solve a key agri-petrol problem by integrating the upstream part of the biofuels sector – agricultural feedstocks and waste materials – with the midstream refining part of the petroleum sector, by transforming biomass into clean biocrude. ●

biofuels international



If you have any products or services relating to the industry to advertise contact **Pierre Gomis +44 (0) 208 648 7092, pierre@biofuels-news.com** or **Margaret Garn +44 (0)20 8687 4126** for editorial content

biofuels international is published on a bi-monthly basis and designed to appeal to those who wish to learn and be kept abreast of the increasingly important area of biofuels, biodiesel, bioethanol, and biomass.

Want to be kept abreast with industry developments and latest news?

Visit our website at www.biofuels-news.com