PRESS RELEASE

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MUSIC publishes Pyrolysis White Paper

Introduction

Always wanted to know what fast pyrolysis of biomass is and how it can be useful? Want to know about the state of the technology and the applications? MUSIC has published a White Paper on Fast Pyrolysis Bio-Oil (FPBO) where all this is explained. In this article an overview is given of the content and highlights of this White Paper.

What is pyrolysis?

Fast Pyrolysis Bio-Oil

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 857806

Pyrolysis is a technology that can convert all types of biomass into a liquid – Fast Pyrolysis Bio-Oil. Bio-oil can be combusted to produce energy, but it is also possible to upgrade it to biofuels, or to make biobased products out of it. Through pyrolysis, 'bulky' biomass can be converted into a versatile liquid, which is easier to transport store and use. It is a way to remove most of the ash from biomass and to homogenize biomass which makes further processing easier. Pyrolysis oil may look the same as fossil oil, but the properties are quite different. It is more acidic, and the 'energy density' – the amount of energy per m^3 – is about half that of fossil fuels like diesel and gasoline. Pyrolysis oil is also not miscible with these fuels.

Where is pyrolysis oil produced?

EMPYRO

Pyrolysis oil is produced in several production facilities already. The company BTG Bioliquids did implement three plants, one in the Netherlands, one in Finland and one in Sweden. The company Envergent technologies has implemented pyrolysis plants in Renfrew and Cote North – both in Canada, and the company Valmet has implemented a plant in Finland. The total operational and planned pyrolysis oil production capacity in Europe stands at 122,000 tonne per year, or 100 million liters per year. In energy terms this amounts to 2 PJ/year. FPBO production capacity in Canada adds about 33% to these numbers.

Energy applications of pyrolysis oil

Pyrolysis oil can be used in boilers as replacement for natural gas or other fossil fuels. Pyrolysis oil produced in the Empyro plant is used this way. Use of pyrolysis oil in a diesel engine is being developed, and BTG recently completed a 500 hour test of a diesel engine on pyrolysis oil [1].

In order to use pyrolysis oil as transport fuel, upgrading is required. This can be done stand-alone, or in a fossil refinery. It is also possible to stabilize the oil and to co-feed the

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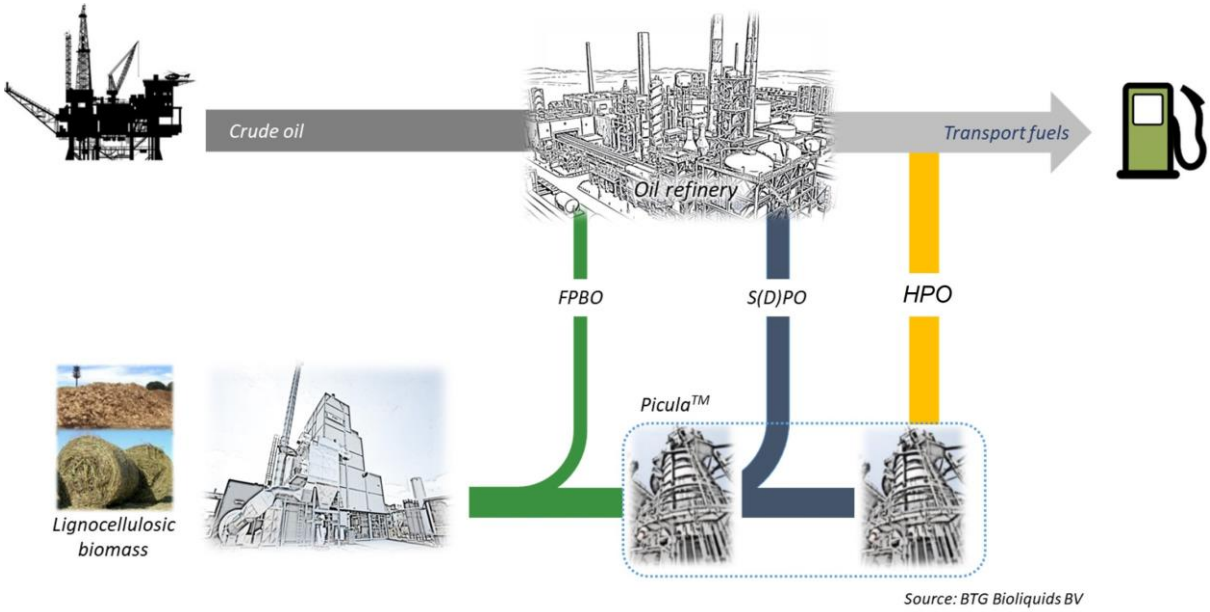
stabilized oil into a refinery.



Transport fuel production via pyrolysis

Co-feeding of pyrolysis oil into a refinery is currently being done in the PREEM refinery in Lysekil (Sweden). Pyrolysis oil produced in the Pyrocell production plant in Gävle (Sweden) is co-fed this way. The maximum amount to be co-fed in a refinery this way is limited. When the pyrolysis oil is stabilised – the product is called Stabilised Pyrolysis Oil or SPO – more can be co-fed. As a result of the co-feeding part of the refinery products are 'green', or in other words of non-fossil origin.

Besides co-feeding, stand-alone upgrading to transport fuels is also being developed. In a two-step hydrogenation process, the pyrolysis oil is first stabilised, and then upgraded using hydrogen. The resulting product – Hydrotreated Pyrolysis Oil or HPO – can then be distilled and used as transport fuels, e.g. for marine applications. This upgrading process is proven at pilot scale (TRL 5-6).

There is a large market for renewable transport fuels, and it is expected that this will lead to the implementation of more pyrolysis plants.

Material applications of pyrolysis oil

Through a relatively simple process – liquid-liquid extraction – pyrolysis oil can be separated into several fractions, for example a lignin fraction, a sugar fraction and extractives. Key advantages of these processes are that essential functionalities are retained in the pyrolytic oil fractions and that no unwanted by-products or wastes are generated. This technology is proven on a demo scale level (TRL 6-7).

Examples of products that can be produced using these fractions are:

Bio-based foam resins

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Bio-based foams

Pyrolytic lignin can be used as partial replacement of phenol in insulating foams, mainly used in the construction sector. The pyrolytic lignin is used as a basis for a phenol-formaldehyde (PF) resin, that is used to produce these foams. These biobased foams show These bio-based foams show improved properties compared to fossil-based foams, especially on the – highly important – fire retardance. Also, the compressive strength is improved.

Moulding compound

Granulated plastic moulding compound is the base material for many moulded plastic products, such a pan handles or parts for the automotive industry. New moulding compounds have been developed that contain a large percentage of bio-based pyrolytic lignin, while maintaining excellent mechanical properties.

Sustainable chemicals from renewable raw materials

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Sand moulding resins

Polyfurfuryl alcohol is a versatile chemical component, currently produced from furfural, which is manufactured mainly outside of the EU, usually using the Quaker Oats batch process. This process has low yields (less than 50%), high energy requirements and generates large amounts of effluent. Polyfurfuryl alcohol is used in bio composites for automotive and furniture applications, fire resistant components for mass transport applications, wood modification, industrial adhesives for foundry, refractory and anti-corrosion applications, and as sand-moulding resins. The pyrolytic sugars from the pyrolysis process can be used in combination with Polyfurfuryl alcohol to increase the sustainability of these products.

Sustainably modified wood

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Modified wood

Softwoods are generally not as suited for outdoor applications as hardwoods. By applying impregnation, softwoods can be modified in such a way that they are just as suitable. The Dutch company Foreco has launched the brand Faunawood, that uses European pinewood impregnated with a special bio-based resin, produced in part from pyrolytic sugars. The result is a durable, strong wood pole, perfect for a wide range of applications. The impregnation ensures the product is not damaged by wood rotting fungi and termites. Old wood poles can be reused to produce the modification resin – making Faunawood a truly circular product.

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