- IDEALFUEL -

Lignin as a feedstock for renewable marine fuels

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Deliverable Report

D2.2 – The optimisation of the pre-treatment and lignin conversion in 300L reactor

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Publishable summary

The EU H2020 project IDEALFUEL aims to develop an efficient and low-cost chemical pathway to convert lignocellulosic biomass into a Biogenic Heavy Fuel Oil (Bio-HFO) - with ultra-low sulphur levels - that can be used as drop-in fuel in the existing maritime fleet. While technical lignins are cheap and available in large quantities, their characteristics are not suitable for the development of high-performance marine fuels. Among others, these lignins suffer from low solubilities, large molecular weight, high sulfur content and are generally non-uniform in their chemical nature. One strategy consists in solvent fractionation of technical lignins to extract a high-quality fraction, which can be more suitable for fuels applications. A second strategy consists in the production of high-quality lignin from biomass with alternative bio-refining process. Within IDEALFUEL, the partners selected solvolysis and Aldehyde-Assisted Fractionation (AAF) as the most relevant technologies to produce high-performance lignin for fuels applications.

After a previous scale up from lab scale to 15L scale, biomass pre-treatment was tested at 250L and 600L scales, validating the production of >5kg of protected AAF lignin per week. Reactions conditions were optimized to maintain high yield while decreasing both costs and use of harmful chemicals. Safety studies, including thermal analysis and HAZOP, were carried out beforehand. Reactor setup was adjusted using nontoxic reactants before first pre-treatment. Minor modifications have been made on an existing equipment and reactors to maximise throughput. Downstream work-up processes have also been adapted to match industrial requirements.

With this equipment in place, kilograms of AAF lignin could be produced on a regular basis. This AAF lignin was then depolymerized by hydrogenolysis under pressure has been scaled up to 20L scale to continue production of lignin oligomers and monomers. Studies on the work up procedure have been conducted to reach pure, sugar-free lignin oligomers isolation by distillation, they will shortly be sent to the partners.

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Project partners:

#	Partner short name	Partner Full Name
1	TUE	Technische Universiteit Eindhoven
2	VERT	Vertoro BV
3	T4F	Tec4Fuels
4	BLOOM	Bloom Biorenewables Ltd
5	UNR	Uniresearch B.V.
6	WinGD	Winterthur Gas & Diesel AG
7		(Formerly SeaNRG, is now GOODFUELS #12)
8	TKMS	Thyssenkrupp Marine Systems GMBH
9	OWI	OWI – Science for Fuels gGmbH
10	CSIC	Agencia Estatal Consejo Superior De Investigaciones Cientificas
11	VARO	Varo Energy Netherlands BV
12	GOOD	GoodFuels B.V.