- IDEALFUEL -

Lignin as a feedstock for renewable marine fuels

GRANT AGREEMENT No. 883753

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"Development of next generation biofuel and alternative renewable fuel technologies for aviation and shipping"

Deliverable Report

D2.1 – Report on the setup of the production line and the optimisation of the process for the production of oligomers

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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 for the production of high-performance lignin for fuels applications.

The AAF biomass pretreatment technology has been recently disclosed by the Laboratory of Sustainable and Catalytic Processing (LPDC) at EPFL and is currently brought to the market by Bloom Biorenewables Ltd (BLOOM), an IDEALFUEL partner. In this report, a detailed description of the setup of the production line and the optimization of the process for the production of oligomers is described.

First, BLOOM has performed AAF of beechwood at the 15 liters scale to produce stabilized lignin in the 200g-scale. The parameters, including selection of reagents and reaction conditions, have been optimized to prevent undesired degradation pathways and yield uncondensed lignin. Lignin has been isolated as a solid by precipitation and characterized by HSQC NMR which revealed a low degree of condensation (high β-O-4 content). In a second step, AAF lignin depolymerization by hydrogenolysis under pressure at the 1 liter scale has been performed to produce lignin oligomers and monomers. Pure, sugar-free lignin oligomers have been isolated by precipitation, sent to the partners and will be characterized in detail within the project.