- IDEALFUEL -

Lignin as a feedstock for renewable marine fuels

GRANT AGREEMENT No. 883753

HORIZON 2020 PROGRAMME - TOPIC LC-SC3-RES-23-2019
"Development of next generation biofuel and alternative renewable fuel technologies for aviation and shipping"

Deliverable Report

D2.3 – Report on the optimization of the BLOOM lignin oligomers-to-CLO (CLO Process #1) process 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 sulfur 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 and/or woody biomass 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 lignin/biomass solvolysis and Aldehyde-Assisted Fractionation (AAF) as the most relevant technologies for the production of high-performance lignin for fuel applications.

Technical lignin solvolysis to an intermediate crude lignin oil (CLO) prior to the bioHFO production, is one of the process solutions within IDEALFUEL project coordinated by WP2. The AAF process enables the production of an uncondensed lignin polymer stream from lignocellulosic biomass. In the second step, a selective catalytic depolymerization process produces a well-defined stream of lignin oligomers. These AAF oligomers via the CLO process, can be used as feedstock for bioHFO production for the maritime industry.

To study the characteristics of AAF oligomers in bioHFO, the solubility has been assessed and it was verified that AAF oligomers (grinded at small and narrow particle size distribution) are fully soluble in methanol at ambient process conditions, in opposition to technical lignins for which solvolysis results in a soluble fraction and an insoluble fraction. CLO with ratio of AAF lignin oligomers:methanol 1:1 w/w have been successfully produced in both lab scale (g) and pilot scale (kg), and quality specifications showed low ash content, low molecular weight and narrow polydispersity as part of the preliminary process and quality control. The acidity levels of the CLO 1:1 were not conclusive and require further research. Further compliance with ISO8217 marine fuel specifications of both the CLO and bioHFO from AAF oligomers, will be assessed by partners within the other fuel-quality and fuel-handling work packages of the project.