UPGRADED PYROLYSIS BIO-OIL AS ALTERNATIVE RENEWABLE SUPPLY IN CLASSICAL PETROLEUM REFINERY PROCESSES

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ABSTRACT

The production of renewable liquid fuels for transport has attracted international research and market interest in line with the ambitious 2020 and 2030 energy and climate targets set by the European Union (EU) policy, considering the increasing global demand for their fossil counterparts and the resulting environmental impact. Toward this direction, the utilization of non-food/feed biomass is promoted, while the most promising bio-chemical and thermo-chemical value chains for biofuels production have been prioritized by the European Industrial Bioenergy Initiative (EIBI), launched under the Strategic Energy Technology (SET) Plan, listing pyrolysis among them [1].

In this frame, the study investigates refinery-compatible entry points to directly co-feed bio-based refinery intermediates and further co-process them in existing petroleum crude oil refineries. The studied pyrolysis bio-oil has been produced via ablative fast pyrolysis and upgraded via mild hydrotreatment (HDT) in order to fulfill refineries' specifications and become a "drop-in" biofuel in compatible refinery "location". The properties of HDT-Bio-oil as well as fossil-based refinery intermediates were compared, and five fossil-based refinery intermediates have been concluded as potential candidates for co-processing. The analysis was based on mapping several petroleum fractions' quality properties (i.e., boiling curve, gravity/density, overall elemental composition, viscosity, surface tension) within a conventional refinery. Based on the comparative assessment, the following refinery streams have been identified as potential candidates for co-processing with HDT-Bio-oil: Straight Run Distillate Diesel (SRGO), Atmospheric Gasoil (GASOIL), Light cycle oil (FCC LCO), Heavy cycle oil (FCC HCO) and Light vacuum gas oil (LVGO). Furthermore, the miscibility of the aforementioned renewable and conventional fuel intermediates has been investigated via light microscopy. In particular, the five mixtures of bio-oil/refinery intermediates were observed under Nikon ECLIPSE TE2000-S optical microscope. Among all refinery streams, Fluid Catalytic Cracking Light Cycle Oil (FCC LCO) and secondly Light Vacuum Gas Oil (LVGO) have been concluded to be the most promising candidates for co-processing, resembling HDT-Bio-oil's properties. The study is part of the "BioMates" Horizon2020 research and innovation EU project, aspiring in combining innovative 2nd generation biomass conversion technologies for the cost-effective production of reliable bio-based intermediates that can be further upgraded in existing oil refineries as renewable and reliable co-feedstocks. Therefore, the current miscibility study acts as a pre-screening of candidate feedstocks for the targeted hydroprocessing study that will follow.

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LITERATURE

[1] EIBI, European Industrial Bioenergy Initiative. http://www.etipbioenergy.eu/?option=com_content&view=article&id=191 [accessed 07 Jen 2019].