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REDIFUEL: Robust and Efficient processes and technologies for Drop-In renewable FUELs for road transport

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Abstract

Besides electrifying short-range transport of people and goods, it is clear that the ultimate solution is to entirely convert the remaining road transport to efficient powertrains running with 2nd or 3rd generation biofuels that comply with fuel economy targets as well as current and future emission standards. Within the project "Robust and Efficient processes and technologies for Drop-In renewable FUELs for road transport" (REDIFUEL), which is funded by Horizon 2020, 12 partners from all over Europe have joint forces. The overall aim is to enable the utilization of various biomass feedstocks for an ultimate renewable EN590 diesel biofuel in a sustainable manner. The proposed drop-in biofuel contains high-cetane liquid (C11-C21) biohydrocarbons and C6-C11 bio-alcohols showing exceptional combustion and pollutant mitigation performance. The process concept relies on the Fischer-Tropsch (FT) reaction for the production of synthetic hydrocarbons from bio-syngas (Fig. 1) leading to C5-C10 α-olefins and C11+-hydrocarbons. By upgrading this fraction into a sequence of hydroformylation and hydrogenation reactions, the olefins are converted to the corresponding C6-C11 alcohols. In total up to 30% of the final blend will consist of this bio-based synthetic alcohol mixture (Fig. 2). Other key conceptual elements are the drop-in capability, the material compatibility, storage stability, lubricant interactions (Fig. 3), the biofuel-engine compatibility, combustion behaviour and emission performance (Fig. 4). Environmental and social aspects are also considered by carrying out a comprehensive Biomass-to-Wheel performance analysis.

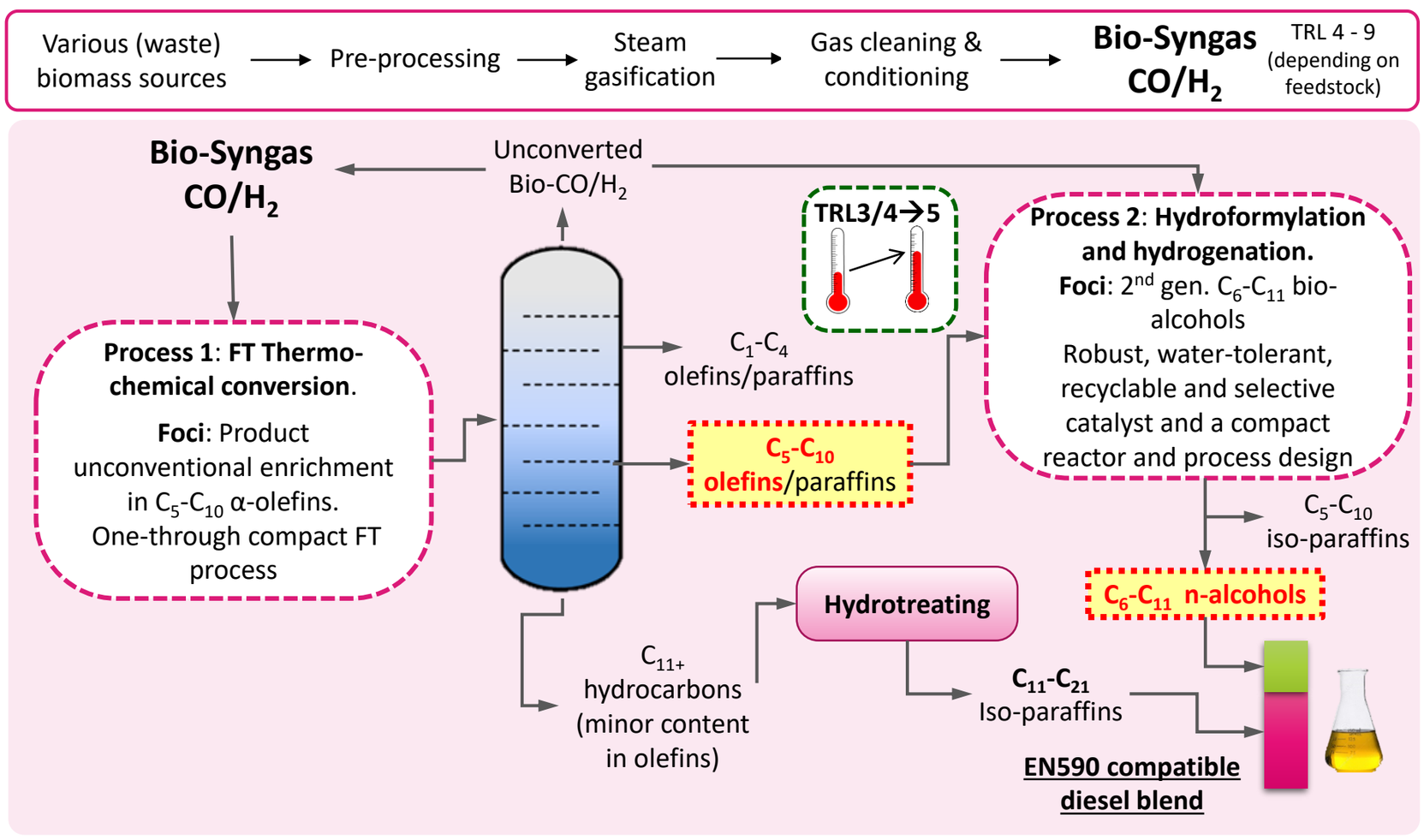

Fig. 1: Process design of REDIFUEL.

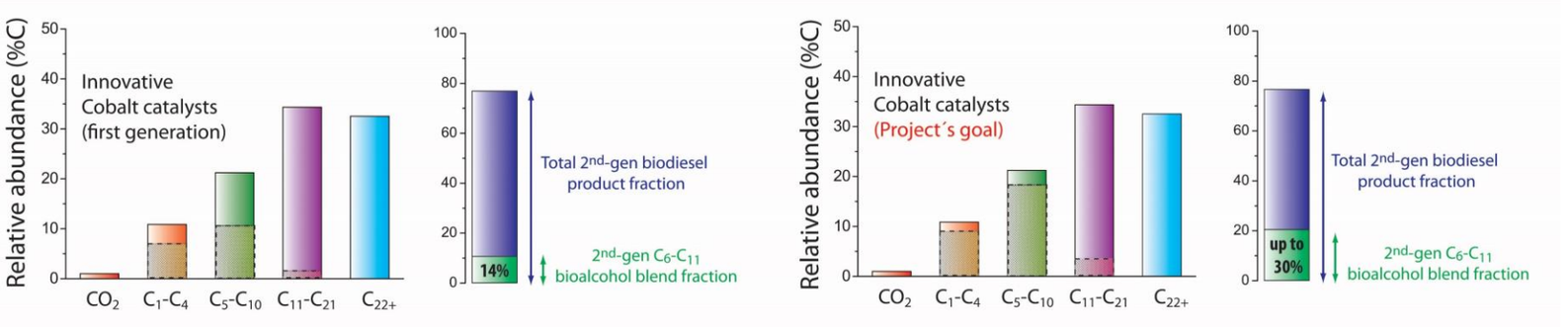

Fig. 2: Schematic representation of the lumped product distribution with cobalt-based Fischer-Tropsch catalysts recently published by project partners (left panel) and projected to be developed within the REDIFUEL project (right panel).

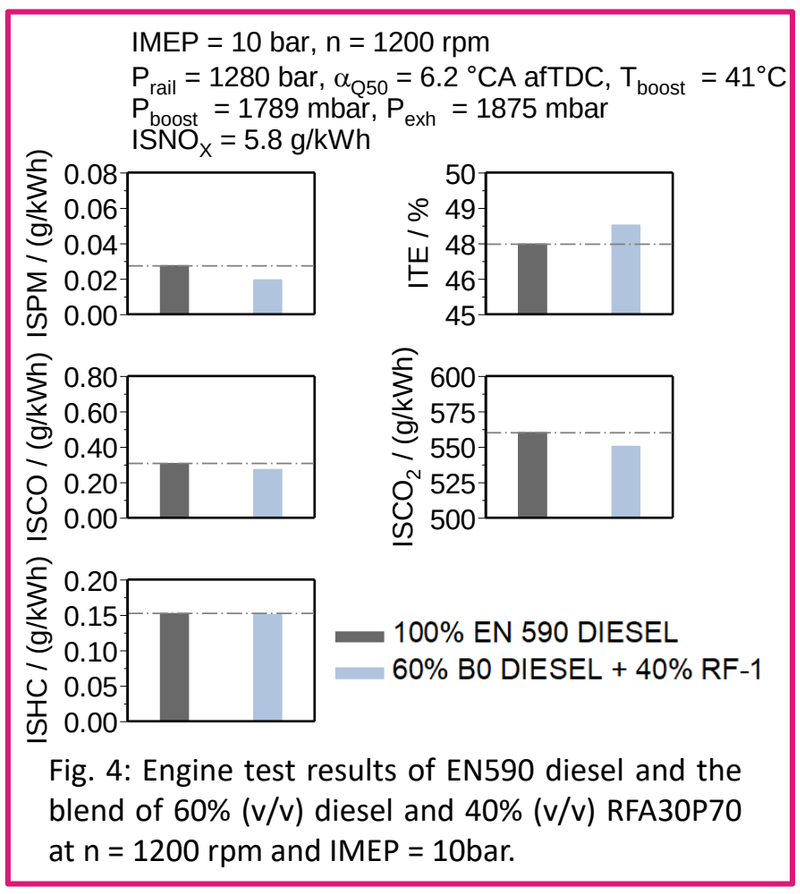

Fig. 4: Engine test results of EN590 diesel and the blend of 60% (v/v) diesel and 40% (v/v) RFA30P70 at n = 1200 rpm and IMEP = 10bar.

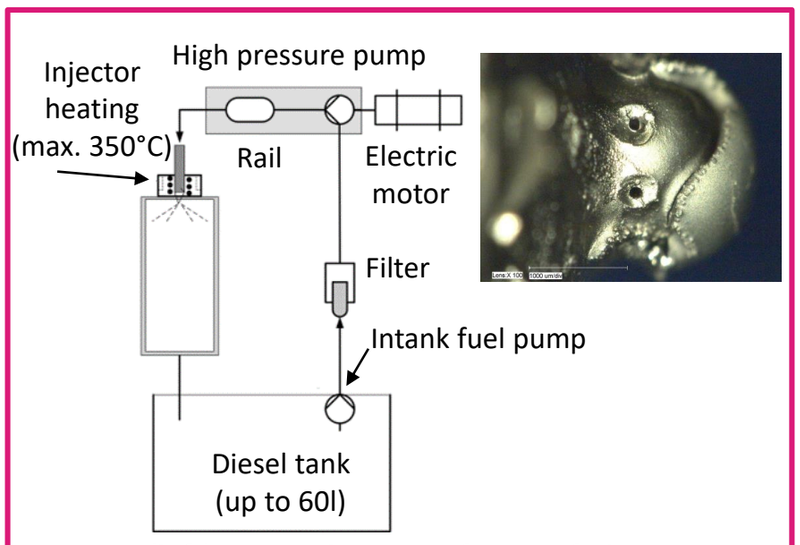

Fig. 3: (left) General setup of one of the 4 test places at the "ENIAK" CoCoS test bench; (right) External deposits after test run (1,300 bar, 10 Hz, 500 µs, B10 with performance additive).

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