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Investigation of Fuel Properties of Various Liquid Synthetic Fuels

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There is a strong request for reduction of greenhouse gas emissions toward carbon neutrality (CN) in 2050, and in order to aim for CN in automobiles, decarbonization of fuels, that is, the reduction of liquid fossil fuel usage is required. Japan Petroleum Energy Center has been conducting research and development since 2021 on the two themes, i.e., "Research and development of next-generation Fischer-Tropsch (FT) reaction" and "Research and development of liquid synthetic fuel manufacturing process with renewable electricity ", in collaboration with industry, academia and government. This research and development (R&D) is a project commissioned by the National Research and Development Corporation New Energy and Industrial Technology Development Organization (NEDO). This R&D aims to establish promising basic elemental technologies in the future, such as electrolytic technology for synthetic gas (H_2 + CO) production, FT synthesis technology for producing hydrocarbons with high affinity for fossil fuels, highly efficient integrated production process technology by combining electrolysis and FT synthesis, and direct FT synthetic technology from CO_2. In addition, fuel utilization research has been conducted as well. Fuel properties and combustion characteristics of FT synthetic fuels produced in this R&D as well as other synthetic fuels procured domestically and overseas are evaluated, and the compatibility with current engines and fuel supply infrastructures are investigated. In addition, the potentials for improving engine performances will be examined by combining those synthetic fuels and future combustion technologies, and the direction of a future fuel quality will be examined. In this report, the results of property surveys of fuels procured domestically and overseas are reported.

(1) Hydrocarbon type fuels, procured in this R&D, conform to the current fuel standards for both gasoline and diesel fuels. It was found that GTL and HVO have higher cetane numbers, and that there is a possibility of improving engine performances in combination with combustion technology in the future.

(2) It was found that the oxygen-containing type fuels ,procured in this R&D, may not meet the standards in many test items even if those small amounts were mixed with the commercial fuels, and may affect the current engines and fuel supply infrastructures. On the other hand, their octane number and cetane number are high. Hence, there is a possibility that the engine performances will be improved in combination with combustion technology in the future. It is important to understand how to use these fuels without adversely affecting the engines and fuel supply infrastructures (such as maximum blend limits and additive utilization, etc.).

(3) Synthetic fuels have mainly been introduced into European market, however, those fuel qualities may vary, depending on the difference in the feedstocks and/or production processes. We will continue to investigate the fuel properties of synthetic fuels marketed overseas and FT synthetic fuels from our R&D.

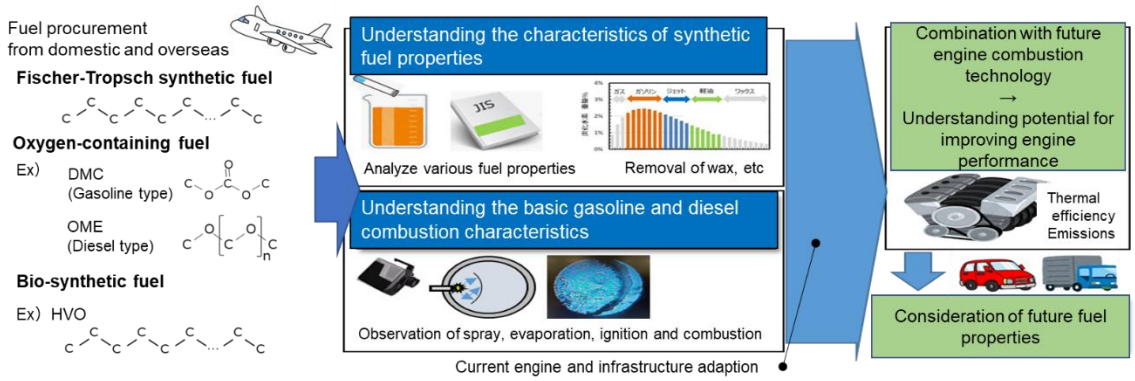

Fig.1 Overview of fuel utilization research

Table1. Confirmation of conformity with JIS regulation (Diesel type fuel)

	Item	Density	Cetane number	Kinematic viscosity	CFPP	PP	PP	Oxidation stability
	Regulation	<0.86g/cm^3	45<	2.5<	-	<-5degC	<-7.5degC	65min.<
Hydrocarbon	GTL		High					
	HVO		High					
	R33							
Oxygen-containing	OME	(>17%)	High	(>22%)	High	(>50%)		(>10%)
		Meet regulation		Not meet regulation		Be careful when mixing		