ALTERNATIVE LIQUID FUELS: SYNTHESIS, PROPERTIES, COMBUSTION*

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Most of the ongoing scientific research in the field of energy and transport is aimed at finding answers to questions related to minimizing fuel consumption, increasing the dynamic characteristics of combustion, reducing harmful emissions into the atmosphere when burning fuels and reducing the cost of their atomization [1, 2]. The share of used synthetic aviation fuels is increasing, in which the presence of molecules of certain classes can be controlled and, due to this, the reactivity and composition of fuel combustion products can be adjusted [3]. In recent years, unique alternative liquid fuels have been proposed to replace traditional hydrocarbon fuels (gasoline, kerosene, diesel fuel) based on plant components (oils, ethers, fats, biomass, etc.) [4]. Various technologies for the synthesis of such fuels are used based on cycles of catalytic cracking, hydrocracking, Fischer-Tropsch synthesis, trans-esterification, transesterification, etc. [5]. One of the most actively developing areas in the world is associated with the synthesis of SAF (Sustainable Aviation Fuel) fuels [1]. There are examples in the world of creating SAF fuels as mixtures of components produced from traditional hydrocarbons and the addition of components from plant raw materials [6]. There are known examples of creating 100% biokerosene using a plant component. Most often, in programs for the development of aviation industries in a number of countries (Europe, the USA, China), compositions are introduced with the addition of 1-15% components based on plant raw materials to traditional hydrocarbon fuels. An analysis of the available data in the international periodical literature shows that the raw materials for the production of SAF fuels are: rapeseed, tall, camelina oils, and cooking fats. Similar components are considered promising for ground-based installations running on gasoline and diesel fuel [7]. Technologies for the synthesis of biogasoline and biodiesel are actively developing. Within the framework of this work, the advantages of each approach to obtaining alternative liquid fuels are determined, taking into account multi-criteria analysis of their synthesis technologies, characteristics of transportation, atomization, storage, and combustion. The results of experimental studies, numerical modeling and bench tests are presented. Unsolved problems in the field of the environmental aspects for the development of fuel technologies and the most promising approaches are identified.

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