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Dissertation abstract

The use of a mixture of hexane and canola oil to fuel a diesel engine

Abstract

The submitted work presents an analysis of the possibility of using a mixture of n-hexane with canola oil to fuel a diesel engine.

The analysis of the issue of using canola oil as a fuel in diesel engines was initially carried out. A literature review showed that the main research directions were focused on analyzing the energy and environmental performance of an engine fuelled by: "pure" canola oil; mixtures of canola oil with diesel, ethers or alcohols; as well as canola oil processed by esterification (FAME) and hydrogenation (HVO). Research was also conducted to determine the durability of engine components fuelled by canola oil. As a result of the research, the advantages as well as disadvantages of using canola oil as fuel were determined. Among the main problems were different physical and chemical properties of canola fuel compared to diesel, affecting the process of pumping and injection, and consequently also combustion. The literature review reveals a significant paucity of scientific publications on research into the use of refined canola oil with low-volume additives in a diesel engine. No study has been found that used the addition of a non-reactive solvent (n-hexane) to canola oil in a small volume. Another issue sparsely reported in the literature was the use of canola oil in compression-ignition traction engines with a tank injection system.

The paper includes the results of experimentally determined physicochemical properties of the fuels used in the study, as well as the results of research and analysis on the effect of n-hexane content in a mixture with canola oil on the performance of a diesel engine observed under static as well as dynamic conditions. In the first stage of the work (preliminary studies), the object of the research was the AD3.152 engine (engine No. 1) with compression-ignition and direct injection, without a supercharging system. The tests were conducted for refined canola oil and its blends with n-hexane containing 5%, 10%, 15%, and 20% volume addition of n-hexane to the fuel. In the second stage of the study, the test object was a diesel engine with a common rail system (engine No. 2), built in a Fiat Qubo vehicle that met Euro 5 exhaust standards. The vehicle was equipped with a five-speed transmission. Studies in this stage were conducted for refined canola oil and its mixtures with n-hexane containing 10%, 15% volume addition of n-hexane.

The first stage served to narrow down the studied volumetric compositions of mixtures of canola oil with n-hexane and to capture such characteristics of the combustion and injection process that would prevent the use of the studied fuel in an engine with a common rail system. In both stages, the results obtained were compared with those obtained for pure canola oil and diesel fuel. The completed scope of the research work made it possible to formulate conclusions, which are presented in the final chapter of the work.

Keywords: canola oil, n-hexane, diesel engine, combustion, common rail, alternative fuels