Abstract

The dissertation presents a number of aspects concerning the analysis of the possibility of powering a spark-ignition (SI) internal combustion engine with a mixture of LPG (Liquid Petroleum Gas) and DME (Dimethylether) gaseous fuels in various mass proportions. The analysis is based on the results of experimental tests of a vehicle with an SI engine, carried out on a chassis dynamometer. A compact class passenger car with a SI engine, which was previously adapted to run on gas fuel, was used for the tests.

Before starting the research, a literature review of published studies on DME was carried out, which contain information on the physicochemical properties of this substance and its use as a fuel in internal combustion engines. The analysis of published sources shows that the basic application of DME is its use as a fuel in diesel engines, in dual-fuel systems with diesel oil. However, there are also known attempts to use DME as a component of the fuel mixture in SI engines. Certain properties of this fuel and theoretical studies seem to confirm the usefulness of such a solution. An additional motivational argument is the fact that DME can be obtained as a renewable fuel.

In this work, the suitability of LPG/DME fuel blend was examined based on the analysis of several fundamental aspects that characterize the operation of an internal combustion engine. Operating parameters, such as power and fuel consumption, were determined, and changes in indicated pressure and limits of the combustion process were analyzed. In addition, the dynamic parameters of a vehicle fueled with blends were compared to the values achieved when powered by LPG. In addition, concentrations of harmful and toxic products of the combustion process were measured for all tested fuels. Measurements were made for selected engine speeds (2000, 2500, 3000 rpm) and for six engine loads (21, 33, 48, 69, 90, 100%). For the implementation of partial loads, an original device was used, which was made especially for the tested vehicle, based on the characteristics of the throttle opening angle. The possibility of improving the operational parameters by correcting the ignition angle was also examined, which was carried out in two stages for all measurement points. LPG and DME fuel mixtures were produced by means of a designed and constructed station, directly before each measurement series.

The work was summarized with general, detailed, methodological, utilitarian and prospective conclusions, which confirm the thesis of the work, which assumes that: "The use of DME as a component of the fuel blend with LPG enables the maintenance of engine performance parameters at a similar or higher level in the full range of its operation". The summary indicates the need and directions for further research with the use of dynamic control

of the fuel composition, due to the impossibility of indicating one, constant composition of the blends to power the engine in the entire range of its operating conditions.