POSSIBILITIES TO DETERMINATE THE BIOFUELS PHYSICALLY PARAMETERS IN FUNCTIONAL CONDITIONS

POSIBILITATI DE DETERMINARE A PARAMETRILOR FIZICI AI BIOCOMBUSTIBILILOR IN CONDITII FUNCTIONALE

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Abstract: *There are currently numerous scientific papers and researches have highlighted the importance of physical properties of bio fuels in optimal functioning of the equipment of injection of internal combustion engines. Properties as viscosity, density and calorific value were considered to be the most important and relevant to current studies and surveys on the use of bio fuels. However, the multitude of researches carried out (both at national as well as internationally) were used as experimental apparatus, the apparatus allowing only change the physical characteristics of property only in terms of atmospheric pressure or in conditions existing inside the combustion chamber. This paper proposes a new approach through the use of research facilities based on the principle of ultrasonic measurements, possibly carrying out such experiments (and the issuance of necessary conclusions) in accordance with the terms of the functional internal combustion engine powered by bio fuel. Establishing the exact physical properties of bio fuel based on functional factors opens the way to new research related to increasing energy efficiency of internal combustion engines fuelled by bio fuel, with the possibility of practical realization of electronic systems (a "flex fuel cell") that allow adaptation functionality injection system with quality bio fuel (fuel) use.*

Rezumat: *Exista la ora actuala numeroase lucrari si cercetari stiintifice care au scos in evident importanta proprietatilor fizice ale biocombustibililor in functionarea optima a echipamentelor sistemului de injectie a motoarelor cu ardere interna. Proprietati ca viscozitatea, densitatea si puterea calorica au fost considerate ca fiind cele mai importante si relevante pentru studiile si cercetarile actuale referitoare la utilizarea biocombustibililor. Totusi, multitudinea de cercetari efectuate (atat pe plan national cat si pe plan international) au utilizat ca si aparatura experimentala, aceea aparatura ce permite doar determinarea variatiei caracteristicilor proprietatilor fizice doar in conditii de presiune atmosferica sau in conditiile existente in interiorul camerei de ardere. Lucrarea prezenta propune o abordare noua prin utilizarea unor echipamente de cercetare bazate pe principiul masurarii cu ultrasunete, fiind posibil astfel realizarea de experimente (si emiterea de concluzii necesare) in concordanta cu conditiile functionale ale motoarelor cu ardere interna alimentate cu biocombustibil. Stabilirea exacta a proprietatilor fizice a biocombustibilului in functie de factorii functionali deschide drumul spre noi cercetari legate de cresterea eficientei energetice a motoarelor cu ardere interna alimentate cu biocombustibil, prin posibilitatea realizarii practice a unor sisteme electronice (de tip "fuel flex cell") ce permit adaptarea functionarii sistemului de injectie cu calitatea biocombustibilului (combustibilului) utilizat.*

Key words**:** *ultrasound, bio fuels, physically properties, functional conditions, IC engine.*
Cuvinte cheie*: ultrasunete**, biocombustibili, proprietati fizice, conditii functionale, motoare.*

INTRODUCTION

The importance of using renewable resources in energy production structure is now evident and is also regulated by numerous European and National directives and laws. Bio fuels are renewable resources that provide benefits through widespread impacts in social,

economic and environmental aspects of using them as alternative fuels [1]. The needs for bio fuels to make up to make the passage from the class of alternative fuels in the fuel class by itself lead to development, experiments and research in order to increase their energy efficiency.

Also by the specific characteristics of the production of bio fuels, they may constitute an element of profit in the agricultural farms, in particular bio fuels based on vegetable oils that can feed the engines with compression ignition which mainly equip tractors and agricultural machinery.

Energy efficiency of bio fuels should be increased in accordance with specific conditions of each functional engine, combining with the physical properties of their food [1]. Most papers and research that have explored this issue have been made through the study of physically and chemically parameters of bio fuels at atmospheric pressure (due to limitations related to the use of apparatuses in specific research), to the pressure existing in the supply systems of engines (1. .. 5 bar), the results are directly influenced by this measurement error, the influence on functional processes in optimizing engine powered by bio fuels.

MATERIALS AND METHOD

To carry out experiments in this study were chosen by a standard diesel fuel (traded over OMV fuel stations) and a biofuel based on vegetable oils type B20 (Biodiesel produced by KLAS SRL).

Characteristics of the two types of fuel are presented in Table 1.

Table 1

Physical and chemical properties of considered fuel and bio fuel

Property	Diesel fuel OMV	Biodiesel KLAS	European standard EN 14214	Units
Cetane number	54	51.2	>51	-
Flash point	65	69	120	^oC
Kinematic viscosity (40^oC)	2.7	3.1	3.5-5.0	mm^2/s
Water content	64	108	<500	mg/kg
Sulphur content	8.8	9.9	<10	mg/kg
FAME content	-	97	>96.5	% m/m
Carbon residue (on 10% distillation residue)	0.02	0.03	<0.3	% m/m
Methanol content	-	0.01	<0.05	% m/m

Experiments conducted on the determination of physical properties of bio fuels in functional conditions were achieved by using the ultrasonic measurement [6]. This method was chosen because many researchers [4, 5] have emphasized that this principle of measurement is considered to have the highest precision. For this purpose was made measuring device with ultrasound (device derived from DUS 20, product of the company Robert Bosch GmbH), based on a sensor transmitter-receiver which operates at frequency of 2.4 MHz, placed and integrated inside of a experimental tank design (Figure 1).

Knowing the speed of sound travelling in the studied liquid can be determined the liquid density (also the liquid viscosity) in the different conditions of temperature and pressure [3, 6], obtained by special construction of the experimental tank (Figure 1).

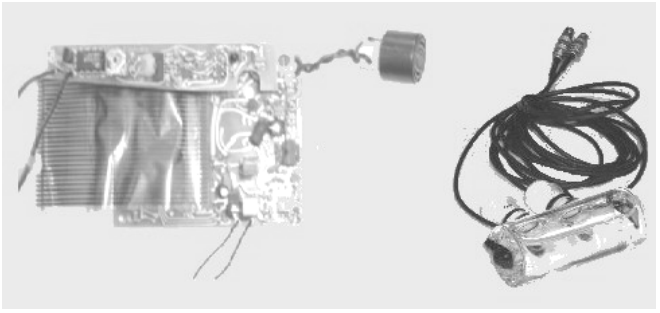

Figure 1. Ultrasound measurement device

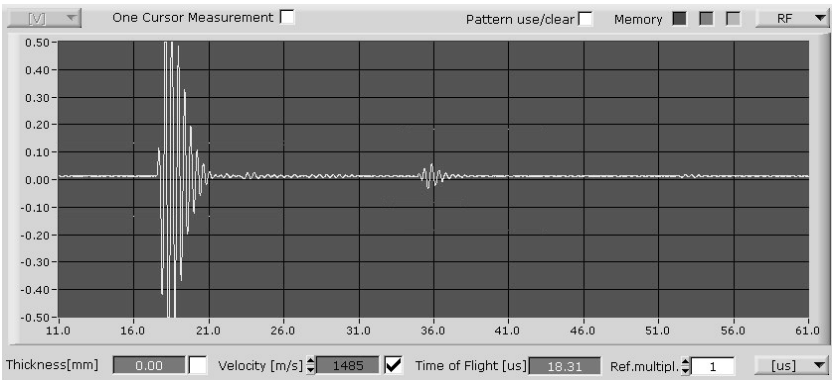

Figure 2. Ultrasound measurement software (OptoEl)

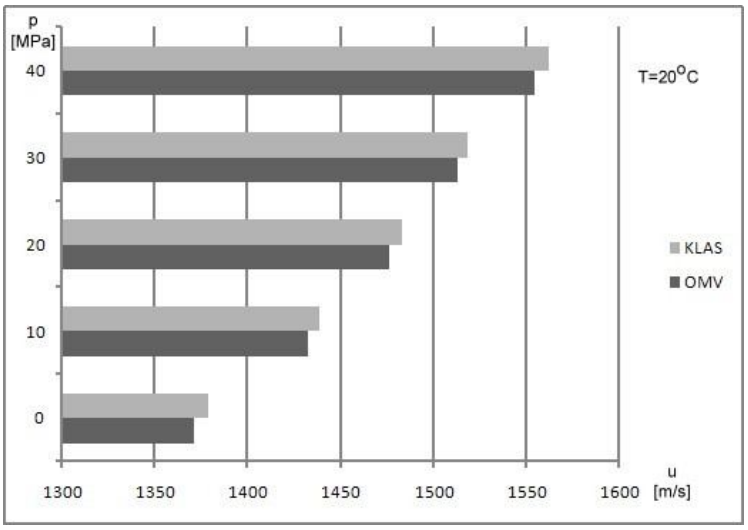

Figure 3. The sound speed variation for T=20°C case (Klas B20 biodiesel, OMV commercial diesel fuel)

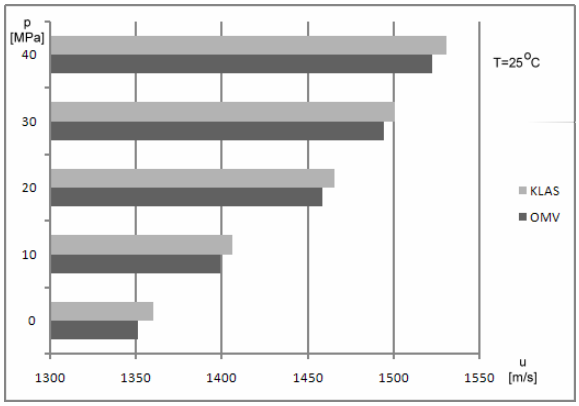

Figure 4. The sound speed variation for T=25°C case (Klas B20 biodiesel, OMV commercial diesel fuel)

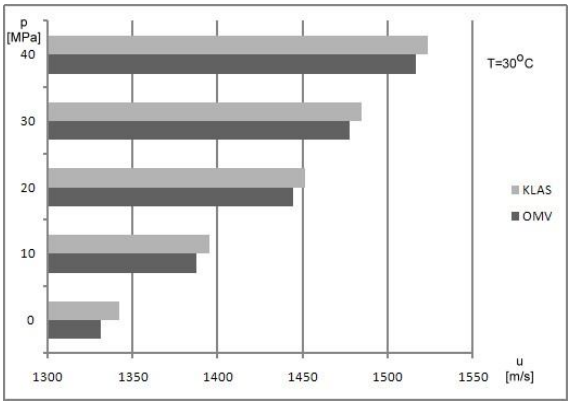

Figure 5. The sound speed variation for T=30°C case (Klas B20 biodiesel, OMV commercial diesel fuel)

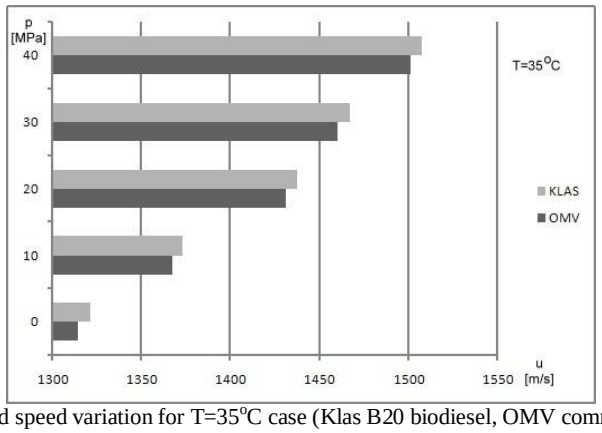

Figure 6. The sound speed variation for T=35°C case (Klas B20 biodiesel, OMV commercial diesel fuel)

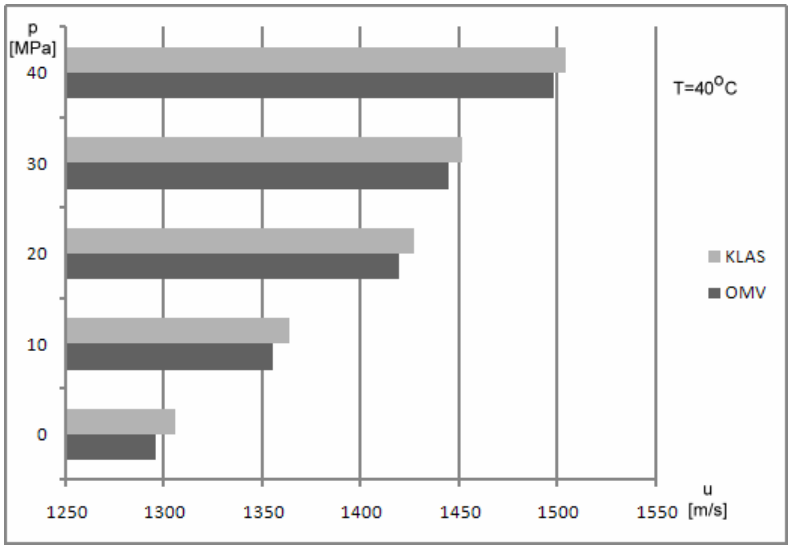

Figure 7. The sound speed variation for T=40°C case (Klas B20 biodiesel, OMV commercial diesel fuel)

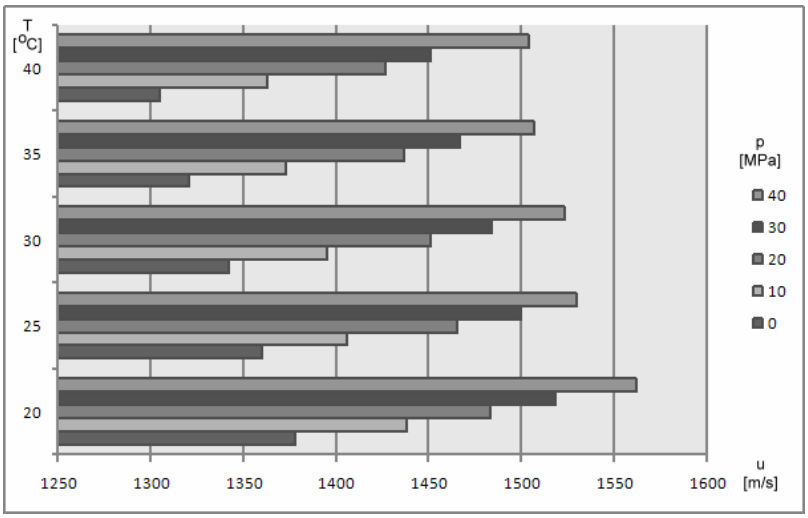

Figure 8. The sound speed comparative variation for Klas B20 biodiesel case

RESULTS AND DISCUSSION

The results obtained in the experiments are presented in the figures 3-8, and are quite equivalents with the results obtained by other researchers, especially for conditions when p = 0 MPa [1]. For the other considered cases the maximum measurement tolerance was 1.7% comparative with the results obtained by [6] for case p = 40 MPa and T = 40°C.

The comparative variation of speed of sound into considered standard fuel and biodiesel B20 type is presented in Table 2.

Table 2

Comparative variation of speed of sound of standard diesel fuel versus B20 biodiesel (in %)

p [MPa]	T [°C]					Average
	20	25	30	35	40	
0	5.1	5.6	6.2	6.3	6.5	5.94
10	4.7	5	5.7	4.3	5.9	5.12
20	4.1	4.8	4.8	4.1	5.6	4.68
30	3.8	4.4	4.7	3.9	4.8	4.32
40	3.7	4.2	4.6	3.8	4.0	4.06
Average	4.28	4.80	5.20	4.48	5.36	

CONCLUSIONS

Based on the study and the analysis presented above we can say that:

• Method of measurement based on the principle of ultrasound offers potential major determining physicochemical properties of bio fuels in conditions similar to those experiments in the existing functional processes of internal combustion engines.

• The increasing pressure and temperature on density bio fuels parameters directly influence the injection process [2]. A longer jet fuel increase the number of drops of fuel that can reach the combustion chamber walls with influences subsequent increase in emission of polluting gases and lower energy efficiency of the combustion process [1]. That show the importance of fuel physically parameters and injection equipment function correlation.

• It is fully possible to use equipment "low cost" based on ultrasound that can optimize the injection with the functioning conditions of internal combustion engines in order to reduce pollution and optimize energy efficiency of the engine in real time.

• Future experiments will be conducted to determine the degree of influence of operational conditions on thermodynamic properties of bio fuels.

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