

CONSIDERATIONS ABOUT THE BIOFUEL FED AGRICULTURAL TRACTORS MAINTENANCE

CONSIDERAȚII PRIVIND MENTENANȚA TRACTOARELOR AGRICOLE ALIMENTATE CU BIOCOMBUSTIBILI

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Abstract: The present paper present the results of an experimental study that concerning the maintenance system for the biofuel fed agricultural tractors. The experiments and measurements was realized in the Biofuels Laboratory of Technical University of Cluj-Napoca, taking into account the functionally condition of compression ignition engine. The mixing formulas of biofuel were in conformity with the existent standards and the basic vegetable oil was Rapeseed oil.

Rezumat: Lucrarea prezintă rezultatele obținute în urma experimentelor efectuate privind mentenanța tractoarelor agricole alimentate cu biocombustibili. Experimentele au fost realizate în cadrul Laboratorului de Biocombustibili al Universității Tehnice din Cluj-Napoca, ținând cont de condițiile specifice de funcționare ale motoarelor cu aprindere prin comprimare. Combustibilii în amestec utilizați sunt pe bază de ulei de rapiță și au fost preparați conform standardelor în vigoare.

Key words: biofuels, maintenance, agricultural tractors, compatibility, rapeseed oil.

Cuvinte cheie: biocombustibili, mentenanță, tractoare agricole, compatibilitate, ulei de rapiță.

INTRODUCTION

The renewable energy sources, that include the biofuels class, can be the right and immediate answers to the questions about the long-term energetic security of European Community. Even those above presented idea is represented as efficient solution for Romanian agriculture in the context of large oil price fluctuation, the using of biofuels as alternative fuel for tractors can improve the benefits that can be obtained from agricultural production [2].

Through the obtained experimental results, we can say that these types of alternative fuels offer the same energetic performance as fossil fuels but with immediate benefits given by:

- very good reducing of pollutants;
- the development of agricultural field of activity;
- social impact through develop of new jobs.

The development of vegetable oils (and the monoesters derivatives) as alternative diesel fuels present some advantages based on:

- a viable alternative to replace the fossil fuels;
- the monoesters-diesel fuel mixture has appropriate properties with diesel fuel;
- strong reduction of carbon oxide and smoke;
- the vegetable oils are ecologically;
- there are no need particularly modifications on fuel storage and distribution system.

In 70's years, the engines which used biofuels were experimented, researched and studied in real and laboratory functional conditions [1,4]. The conducted researches were starting to:

- monocylinder engines to multiplecylinders engines (12 cylinders);

- indirect injection process (IDI) to direct injection process (DI);
- using the diesel fuels-vegetal oil mixture (the part of vegetable oil varies between 2% and 100%);
- using the various classes of additives (to improve the different physical and chemical properties of vegetable oils).

The period of testing of the engines that run with biofuels was between 10 and 5000 hours and some vehicles and stationary engines was supervising at the long period of 14 years of functioning with biofuels [4].

There are a lot of studies and researches concerning the engine parts and biofuels compatibility that was realized by engines manufacturers (Cummins), tractors manufacturers (John Deer, Ford, Mitsubishi), auto vehicles manufacturers (Mercedes Benz, Ford, Dodge), automotive spare and supply parts (Foseen Manufacturing and Developing Company, Parker, Wilden Chemical, 3M, e-Funda), universities and governmental agency all over the world.

Also it is very important to use renewable materials in construction of tractors components, such as polypropylene for a future ecologically industry.

MATERIALS AND METHOD

The conducted experimental studies analyze the effect of the biofuels solvent properties on the Romanian tractors fuelling system and engine's main components. It is important to mention that in the period when the majority of Romanian tractors (and tractors engine accessories) were designed and produced, the only fuel that was take in consideration to use in engine feed was only the diesel fuel and a number of over 110,000 of those are still considered to be in function.

The experiments was realized using the proof-stand for IC engines (to determinate the biofuels effects above the engine's main parameters and the biofuels influence on the engine components) and into laboratory (to determinate the biofuels effects on physically properties of the engine accessories as example fuel filter sealing elements).

Table 1

Physical and chemical properties of Rapeseed oil

Properties	Rapeseed oil
Density at 15°C [kg/dm ³]	0,92
Caloric power [MJ/kg]	37,6
Cinematic viscosity at 20°C [mm ² /s]	74
Cetane number	40
Pour point [°C]	-15...-18
Flash point [°C]	317
Iodine index	94-118

The experiment was realized taking account of functionally condition of compression ignition engine D-118 (that is use in a large number of Romanian tractors), especially those that are linked about the maximum value of temperatures that can be reached by the feed

system parts and components (50°...80°C). The mixing formulas of biofuels were in conformity with the existent standards and the basic vegetable oil was Rapeseed oil.

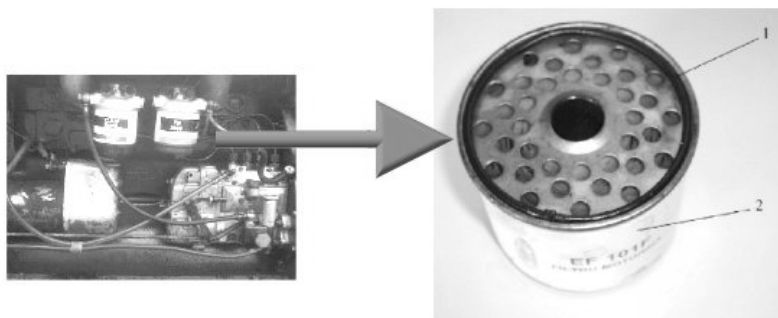


Figure 1. The D-118 engine, the position of fuel filter battery system and the fuel filter (1-rubber seal; 2-fuel filter)

One of the experiments shows the influence of biofuels actions on fuel filter rubber seal (Figure 2) and measurements of thickness were (deformation of) inside of a filter mechanical squeeze assembly). The considered value of squeeze moment was 20 Nm.

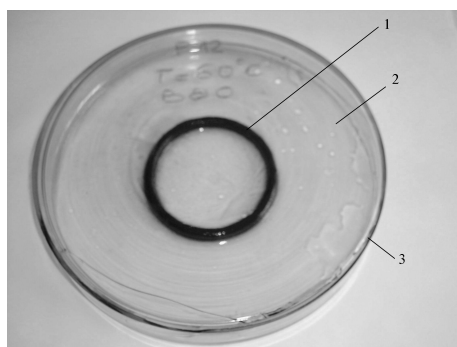


Figure 2. Glass container with rubber seal in biofuel (1-fuel filter rubber seal sample; 2- biofuel; 3-glass container)

The data's measurement was 20 days period for four specific temperatures and for six types of biofuel (Rapeseed oil-diesel fuel) mixtures.

To determine the biofuels influence on the engine components was use the same D-118 tractor engine. The tests were conducted for an engine functioning with biofuel period of 180 hours.

RESULTS AND DISCUSSION

The obtained experimental results for fuel filter sealing rubber element are presented in Figures 3-5. The results observed about the biofuel influence on engine fuelling system (gums deposits) are presented in Figures 6-8.

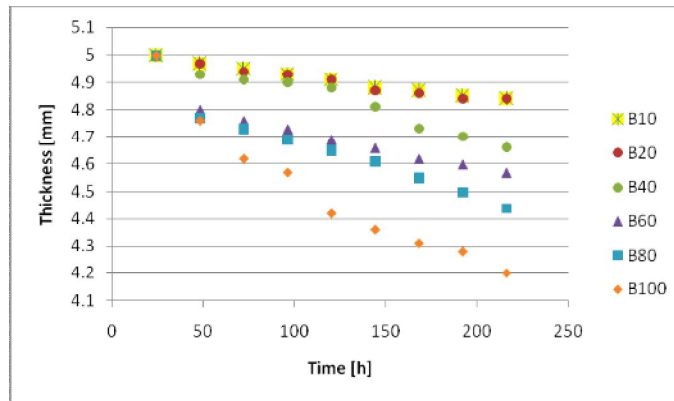


Figure 3. Variation of rubber seal thickness for T=50°C

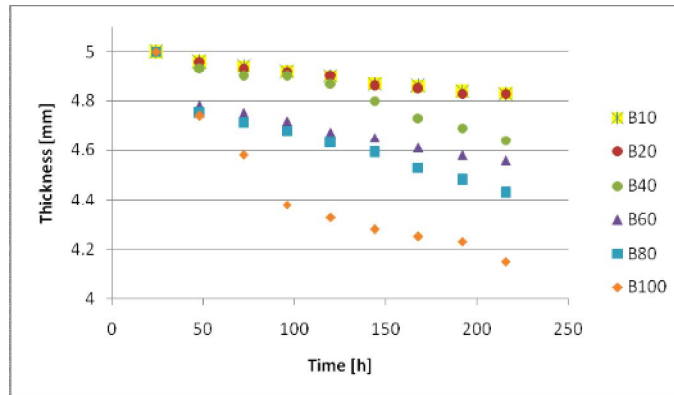


Figure 4. . Variation of rubber seal thickness for T=60°C

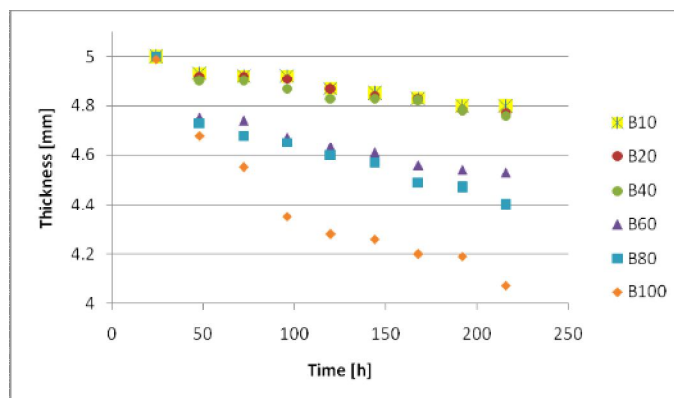


Figure 5. . Variation of rubber seal thickness for T=80°C



Figure 6. The influence of biofuel use on cylinder cover and valve seat (left-biofuel use; right-diesel oil use)



Figure 7. The influence of biofuel use on piston head (left-biofuel use; right-diesel oil use)



Figure 8. The influence of biofuel use on injectors (left-biofuel use; right-diesel oil use)

CONCLUSIONS

- It can be seen that the amplification of natural solvent biofuels property once to increase of the temperature and also with the increasing of concentration level of vegetable oil in biofuel mixture:

- 3.3-26% variation in thickness (from initial conditions) for B10 to B100 biofuel type at 50°C.
- 3.4-28% variation in thickness (from initial conditions) for B10 to B100 biofuel type at 60°C.
- 3.4-30.6% variation in thickness (from initial conditions) for B10 to B100 biofuel type at 70°C.
- 4.2-31.2 % variation in thickness (from initial conditions) for B10 to B100 biofuel type at 80°C.

- There are not major treats in using rubber as sealing fuel filter element as components or spare parts for biofuels that contain till 20% Rapeseed oil in volume of mixture (the variation of thickness remain approximately constant at 4%) for the period of time that was considered in this experiment. It can say that for biofuels that contain more that 20% Rapeseed oil in volume can be some sealing problems due to the apparition of great

deformation of geometrical shape of rubber seal fuel filter element. Are necessary future studies for a longer period and obtaining the proper information from users about the fuel filter sealing element structural comportment in conditions of using biofuel for feeding the tractors engine. For the engine's main components the experiments show that after the test period inside of fuelling system are some deposits (mainly because of the insufficient biofuel quality).

- It is important also to mentioned that the time period of experiment was 180 days that correspond to 1440 functioning hours of tractors engine that is sufficiently to work till to a periodic maintenance operation, when can be replace the fuel filter.

- For ignition compression engine D-118 and D-110, that equipped a large number of Romanian U650 type tractors (113.671 [5]) is recommended to develop a self-maintenance system (if the replacing cost or manufacturing from other material type of rubber seal cost are high) to ensure the optimal condition to use the tractors, without any fuel leakage. The experiments show that the optimal time-period for maintenance operation must be reduce (as it is in present specifically for each tractor engine type) with a 10-15%.

- It is necessary to continue the study for other classes of plastic moulding compound to identification of their compatibility with different types of biofuels used in feed of ignition compression engines, function of physically and mechanically properties and to optimize the manufacturing cost of the components or parts makes from those classes of plastic moulding compounds.

LITERATURE

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