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Cotton Oil and Sunflower Oil Fuel Mixtures

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Abstract

Air pollution is made up of many kind of gases, droplets and particles that reduce the quality of the air. Particles include dust, dirt, soot, smoke and liquid droplets. Some of these particles are large enough to be seen as soot or smoke, while others are so small that can be detected individually with a microscope. Some particles are emitted directly into the air from a variety of sources that are either natural or related to human activity. Those related to human activity include motor vehicle emissions, industrial processes such as electricity generation, incinerators and stone crushing. At this paper will be compared the emissions of pollutants when are used as a fuel the mixtures of diesel-cotton oil and diesel- sunflower oil in a Diesel four-stroke engine. Specifically, the mixtures that have been used are the following: diesel-10% cotton oil, diesel-20% cotton oil, diesel-30% cotton oil, diesel-40% cotton oil, diesel-50% cotton oil, diesel- 10% sunflower oil, diesel- 20% sunflower oil, diesel- 30% sunflower oil, diesel- 40% sunflower oil, diesel- 50% sunflower oil. For those mixtures, it has been measured the emissions of Carbon monoxide (CO), hydrocarbons (HC) and Nitrogen monoxide (NO) and also the fuel consumption.

Key words: Gas emissions; Cotton oil; Sunflower oil; CO-HC-NO-smoke emissions; Biofuels

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INTRODUCTION

Clean air is an important factor in the quality of life. Therefore, air pollution is something that we cannot really ignore, as it affects negatively the environment and consequently the sustainability of our lifestyle and production methods. Air pollution is evident from the moment we step out of our house and greeted with black colored smog that hit us directly. This smog is not due to climate but rather due to each and every one of us. The main causes of air pollution is the carbon dioxide, the burning of fossil fuels, the release of harmful gases into the atmosphere from the increased number of power plants and manufacturing units or industries, activities that involve the burning of wood, fumes that are released from aerosol sprays, military activities that involve the use of nuclear weapons etc. Among all the pollution sources in a city the road transport emissions are often the most important source. In nowadays there is a great increase in car ownership and use. Also residential and dispersed sources of pollution, such as heating with wood, back yard burning and domestic appliances are small but numerous significant sources of air pollutants. Therefore, it remains to be seen what measures needs to be adopt, in order to adverse air quality as well as those pollutants that continue to pose threats to the environment and human health.

One way to achieve this is to improve the fuel quality and reduce vehicle emissions from road traffic. This can be succeed by the use of alternative fuels. Alternative fuels are derived from resources other than petroleum. Some are produced domestically, reducing dependence on foreign oil and some are derived from renewable sources. There are a number of parameters that effect the vehicle exhaust emissions, such as the fuel and air mixing, the temperature of combustion and the time available for combustion in the engine. Also the fuel that is used to power the engine influences emissions. Alternative fuels produce less pollution than gasoline or diesel. The transportation fuels that are made from biomass through biochemical or thermochemical processes are known as biofuels. Examples of well known alternative fuels and particularly biofuels include biodiesel, ethanol and methanol. (Maxwell and Jones 1995; Owen and Coley 1995; Schafer and Basshuysen 1995).

Biodiesel is an alternative fuel made from soybean, canola or other vegetable oils, such as animal fats and recycled grease. It contains no petroleum, but it can be blended at any level with petroleum diesel to get different blends like B2 (2 percent biodiesel and 98 percent conventional diesel) or B20 (20 percent biodiesel) or it can be used as 100 percent biodiesel (B100). Most diesel powered vehicles can use biodiesel without conversion or alteration of the engine. The use of biodiesel in a conventional diesel engine results in substantial reductions of unburned hydrocarbons, carbon monoxide and particulate matter compare to emissions from diesel fuel. Additionally, biodiesel exhaust has a less harmful impact on human health than petroleum diesel fuel. (Vol. II B, p.8:39,STU information No 580,1986).

Another renewable fuel is ethanol, as it is produced from agricultural crops or from recycled wastes and residues. Specifically, it is made by converting the carbohydrate portion of biomass into sugar, which is then converted into ethanol in a fermentation process similar to brewing beer. Ethanol can be used as a motor fuel in regular and racing cars with few engine modifications. It includes a high octane rating that results in increased engine efficiency and performance. Another positive feature of ethanol use as a motor fuel is that it reduces greenhouse gas emissions from transportation sources. (Menrad and Haselhorst 1981).

Methanol is also known as a wood alcohol or methyl alcohol and is made from woody plant fiber, coal or natural gas and also municipal solid wastes and sewage. It is quite corrosive and poisonous and has lower volatility compared to gasoline, which means that is not instantly flammable. It is used primarily as a supplement to gasoline, but it can be used directly as an automobile fuel with some modifications of the automobile engine. Pure methanol is commonly used as a racing fuel. As a motor fuel for general transportation it is mixed with gasoline to produce M85 (85 percent of methanol and 15 percent of gasoline). It is also the primary alcohol used to mix biodiesel. Methanol's physical and chemical characteristics offer several advantages as an alternative fuel. Benefits include relatively low production cost and a lower risk of flammability compared to gasoline. In addition, methanol can be manufactured from a variety of carbon based feedstocks such as coal.

Biofuels are renewable since they are produced from biomass-organic matter, such as plants. They generate about the same amount of carbon dioxide (a greenhouse gas) from the tailpipe as fossil fuels, but the plants that are grown to produce the biofuels actually remove carbon dioxide from the atmosphere. (Arapatsakos, Karkanis, Sparis 2004).

The question that arises is how a four-stroke diesel engine behaves on the side of pollutants and operation, when it uses mixed fuel of diesel and cotton oil. At the present paper will be examined the comparison (on the side of pollutants and operation) about cotton oil and sunflower oil when it uses mixed fuel of diesel-cotton oil and diesel-sunflower oil in a four-stroke diesel engine.

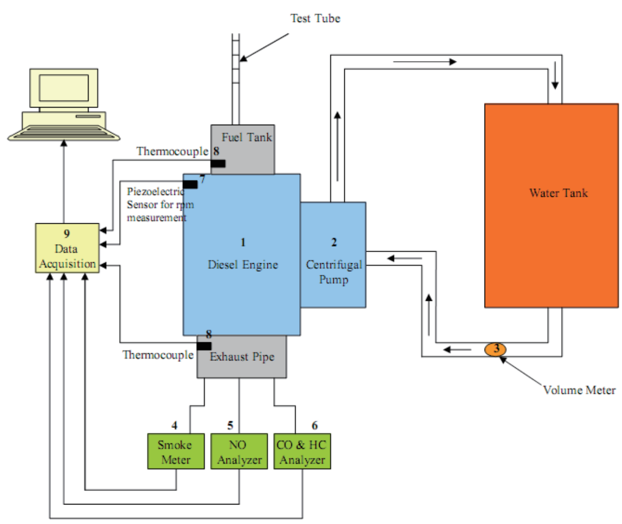
1. INSTRUMENTATION AND EXPERIMENTAL RESULTS

In the experiment stage has been used directly cotton oil and sunflower oil in the mixture of diesel in to a four–stroke Diesel engine and not elaborated in the figure of bio-diesel. Specifically it has been used Diesel, mixture Diesel-10% cotton oil(B10), Diesel-20% cotton oil(B20), Diesel-30% cotton oil(B30), Diesel-40% cotton oil(B40), Diesel-50% cotton oil (B50), Diesel- 10% sunflower oil(H10), Diesel- 20% sunflower oil(H20), Diesel- 30% sunflower oil (H30), Diesel- 40% sunflower oil (H40), Diesel- 50% sunflower oil (H50), in a four-stroke diesel engine named Ruggerini type RD-80, volume 377cc, and power 8.2hp/3000rpm, who was connected with a pump of water centrifugal. Measurements were made when the engine was function on 1000, 1500, 2000 and 2500rpm.

1.1 Experimental measurements

During the experiments, it has been counted:

- The % (CO)
- The ppm of HC
- The ppm of NO
- The % of smoke



Picture 1
Experimental Layout

The measurement of rounds/min of the engine was made by a portable tachometer (Digital photo/contact tachometer) named LTLutron DT-2236. Smoke was measured by a specifically measurement device named SMOKE MODULE EXHAUST GAS ANALYSER MOD 9010/M, which has been connected to a PC unit. The CO and HC emissions have been measured by HORIBA Analyzer MEXA-324 GE. The NO emissions were measured by a Single GAS Analyser SGA92-NO.

1.2 Experimental Results

The experimental results are shown at the following tables and figures:

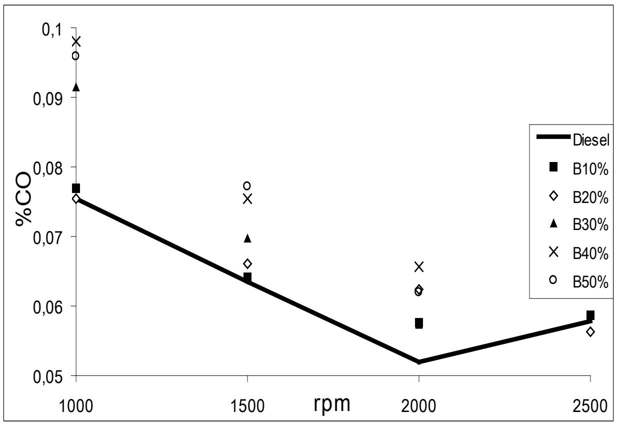


Figure 1
The CO Variation On Different rpm when Used as Fuel Mixtures of Diesel-Cotton Oil

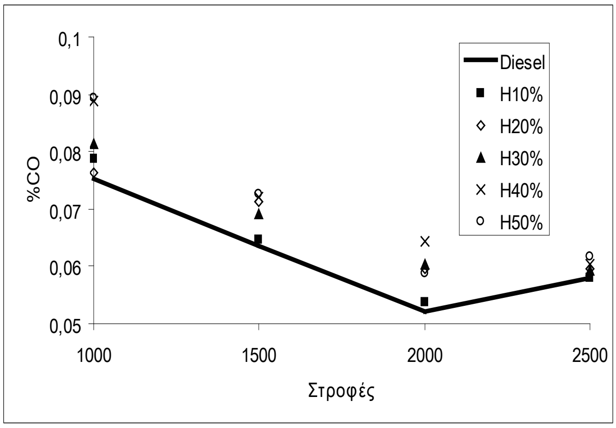


Figure 2
The CO Variation on Different rpm when Used as Fuel Mixtures of Diesel-Sunflower Oil

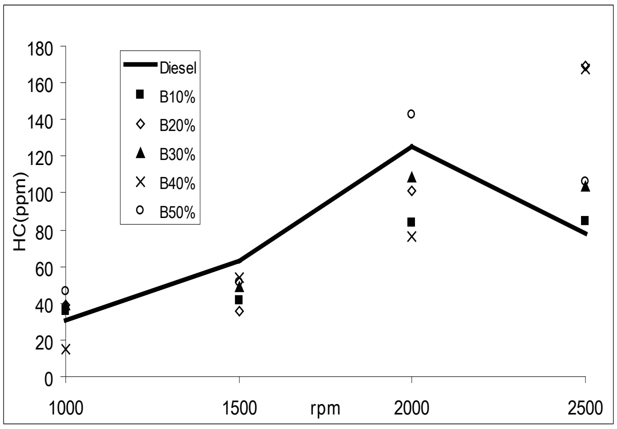


Figure 3
The HC Variation on Different rpm when Used as Fuel Mixtures of Diesel-Cotton Oil

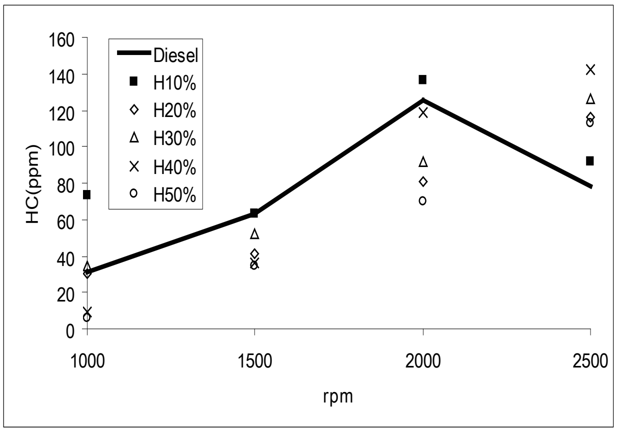


Figure 4
The HC Variation on Different rpm when Used as Fuel Mixtures of Diesel-Sunflower Oil

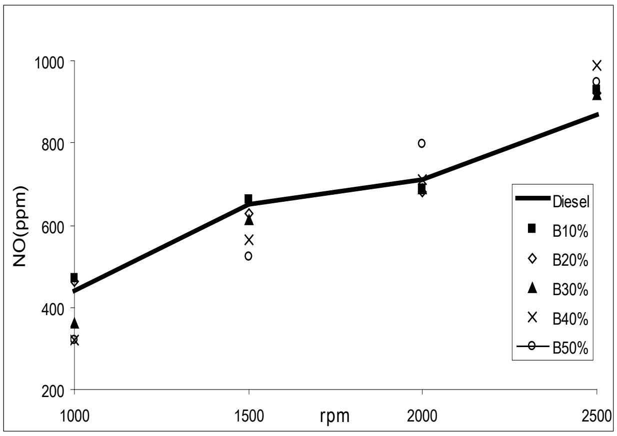


Figure 5
The NO Variation on Different rpm when Used as Fuel Mixtures of Diesel-Cotton Oil

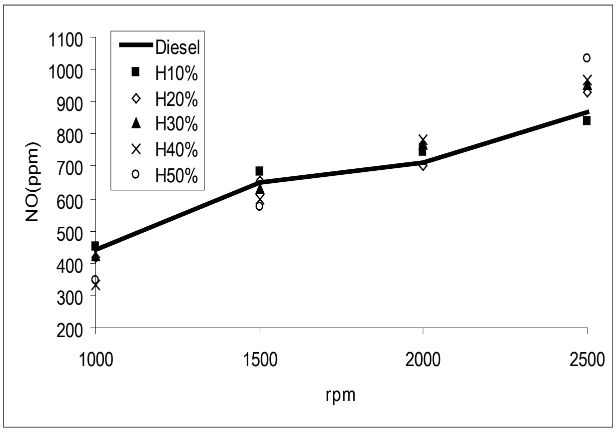


Figure 6
The NO Variation on Different rpm when Used as Fuel Mixtures of Diesel-Sunflower Oil

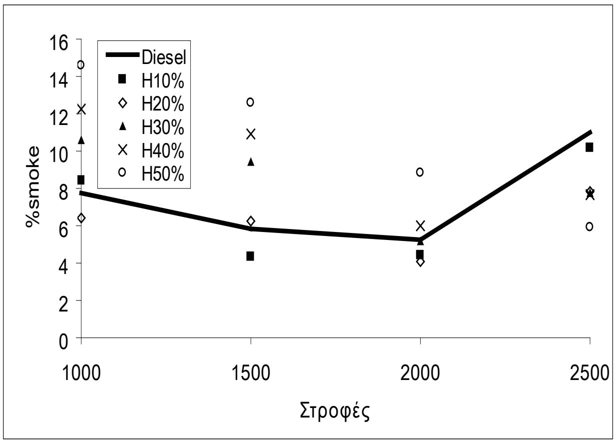


Figure 7
The Smoke Variation on Different rpm when Used as Fuel Mixtures of Diesel-Cotton Oil

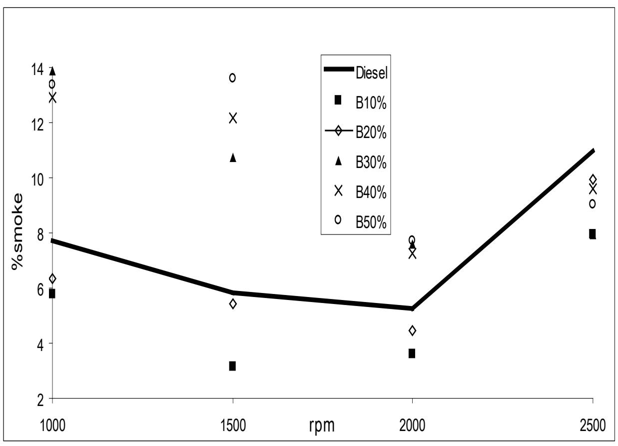


Figure 8
The Smoke Variation on Different rpm when Used as Fuel Mixtures of Diesel-Cotton Oil

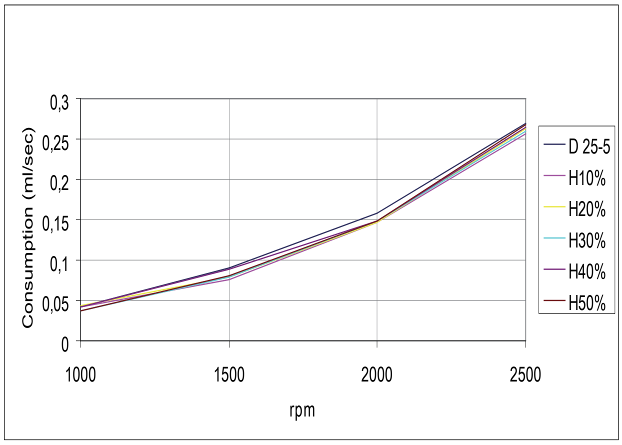


Figure 9
The Fuel Consumption when Used as Fuel Mixtures of Diesel-Sunflower Oil

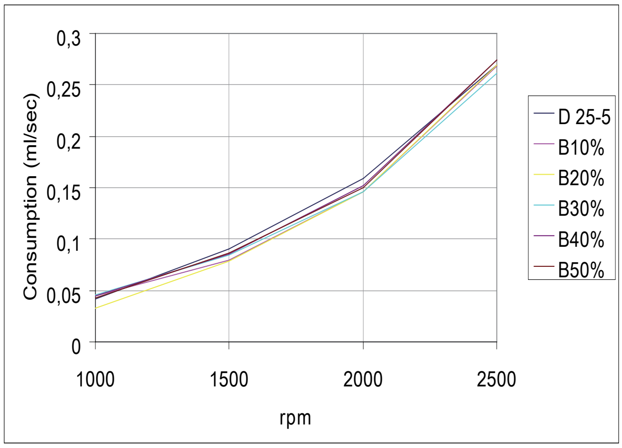


Figure 10
The Fuel Consumption when Used as Fuel Mixtures of Diesel Cotton Oil

CONCLUSION

(1) The use of mixture of diesel-cotton oil has the following impacts:

About CO it can be noticed an increase when the cotton oil is used as a fuel.

About HC it can be noticed a reduction at 1500 rpm and particularly bigger reduction in the use of B20. It also appears reduction of the HC for all the mixture at 2000 rpm with the exception of B50. Finally about the HC, for all the mixture at 2500 rpm is observed increase of HC regarding to Diesel.

About NO it has been noticed a reduction at 1000 rpm and 1500 rpm for all the mixtures. A small reduction appeared for all the mixtures at 2500 rpm with the exception of B50, regarding to Diesel. Finally about the NO for all the mixtures appeared increase at 2500 rpm regarding to Diesel.

About the smoke it can be noticed a reduction of the mixture of B20 and B10, but it appears an increase for all other mixtures in any round regarding to Diesel, with the exception of 2500 rpm, in where all the mixtures appear a reduction. (Arapatsakos, Christoforidis, Karkanis, Mitroulas, Teka 2007; Arapatsakos, Christoforidis, Karkanis, Mitroulas, Teka 2008)

(2) The use of mixture of diesel-sunflower oil has the following impacts:

Regarding to CO emissions, diesel presents the less concerning all the mixtures of diesel - sunflower oil. The diesel - sunflower oil mixtures (excluding H10%), present less HC emission concerning to diesel. When the engine works in the low turns (rpm), diesel appears to have more NO emission concerning to diesel – sunflower oil mixtures, the situation is reversed when the engine works in higher turns (rpm). The H10% and H20% present less smoke emission concerning to diesel. The power of engine has not been influenced from the use of different mixtures, as there was no change of turns and water supply too. The consumption of fuel has not been influenced from the use of different mixtures. Future search constitutes the use of percentages of sunflower oil under 10%. H10% and H20% present better behavior than side of pollution by all the mixtures. Also the consumption remains the same with Diesel, even if changes the constitution of fuel. (Arapatsakos, Karkanis, Christoforidis, Mitroulas, Teca 2008).

(3) Comparing the mixtures of diesel-cotton oil and diesel-sunflower oil:

About CO and HC the mixtures of diesel-sunflower oil appeared better behavior than the mixture of diesel- cotton oil.

About NO and smoke the mixture of diesel- cotton oil appeared better behavior than the mixtures of diesel-sunflower.

About the fuel consumption there is no differentiation among the mixtures of diesel-sunflower and mixtures of diesel- cotton oil. (Arapatsakos 2010)

Finally, in terms of engine did not present any problem by the use of diesel- cotton oil and diesel-sunflower oil mixtures.

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