Fuel mixtures of diesel-maize oil

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Abstract: - Petroleum – based fuels is a finite resource that is rapidly depleting. Consequently, petroleum reserves are not sufficient enough to last many years. Considering also the fact that petroleum – based fuels, can cause many environmental problems, imbalance of trade, high oil process etc, it becomes necessary the development of alternative fuel sources. At this paper will be examined the use of diesel-maize oil mixtures in diesel four-stroke engine. The mixtures used are the following: diesel-5% maize oil, diesel-10% maize oil, diesel-20% maize oil oil, diesel-30% maize oil, diesel-40% maize oil, diesel-50% maize oil. For those mixtures the gas emissions of carbon monoxide (CO), hydrocarbons (HC), nitrogen monoxide (NO) are being measured and the fuel consumption is also examined.

Key-Words: - Gas emissions, maize oil fuel, Biofuels

I. INTRODUCTION

In our days most of the transportation vehicles run on gasoline or diesel fuel. Some of the consequences of this use are the environment pollution and the need of imported oil as well. There is growing perceived economic and political need for the development of alternative fuel sources.[1,2,3,4,5,6] This is due to general environmental, economic, and geopolitical concerns of sustainability. An alternative fuel refers to a vehicle that runs on a fuel other than traditional gasoline or diesel, any method of powering an engine that does not involve solely petroleum. Ethanol is a liquid alcohol fuel produced from biomass (which consists of trees, grasses and wastes) grain or agricultural waste. It produces less greenhouse gas emissions than conventional fuels[7,8,9,10]. However, mileage is reduced because this fuel has a lower extremely cold temperature. Also there is a need of special engine oil and frequent oil changes, in order for ethanol to be used as a fuel. Methanol is also known as a wood alcohol or methyl alcohol and is made from natural gas, wood, coal or biomass. Natural gas or methane, originates in the ground, but also is made from biomass. It generates less air pollutants and greenhouse gasses. A car that runs on natural gas needs more fuel space and a limited driving range, as the equivalent amount of natural gas takes up about four times more space than a gallon of gasoline[11,12,13,14,15]. Propane also called liquefied petroleum gas (LPG), is a domestically abundant fossil fuel that generates less harmful air pollutants and greenhouse gasses. However, vehicles that use propane as a fuel, require special equipment for refueling, a short driving range and all repairs need to be done by a technician, who is qualified to work on a propane system[16,17,18].

Biofuels are the fuels that are being produced from biomass. Furthermore, biofuel is defined as solid liquid or gas fuel derived from relatively recently dead biological material. It can be used to power vehicles, heating home and cooking stoves. Biofuels can replace conventional fuels, completely or partially, in the internal combustion engines.[19]. 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[20,21,22]. When alternative fuels are used instead of the usual petroleum-based fuels, the vehicular emissions are reduced. Using renewable fuels, such as biofuels, there is also a reduction of carbon dioxide (CO_2) in the atmosphere. Carbon dioxide is non-toxic but contributes to the greenhouse effect[7,8]. One of the advantages of biofuel is that decreases emissions when it is used as it is renewable. As a result biofuel is friendly to the environment when it is used as a fuel instead of petroleum[23,24].

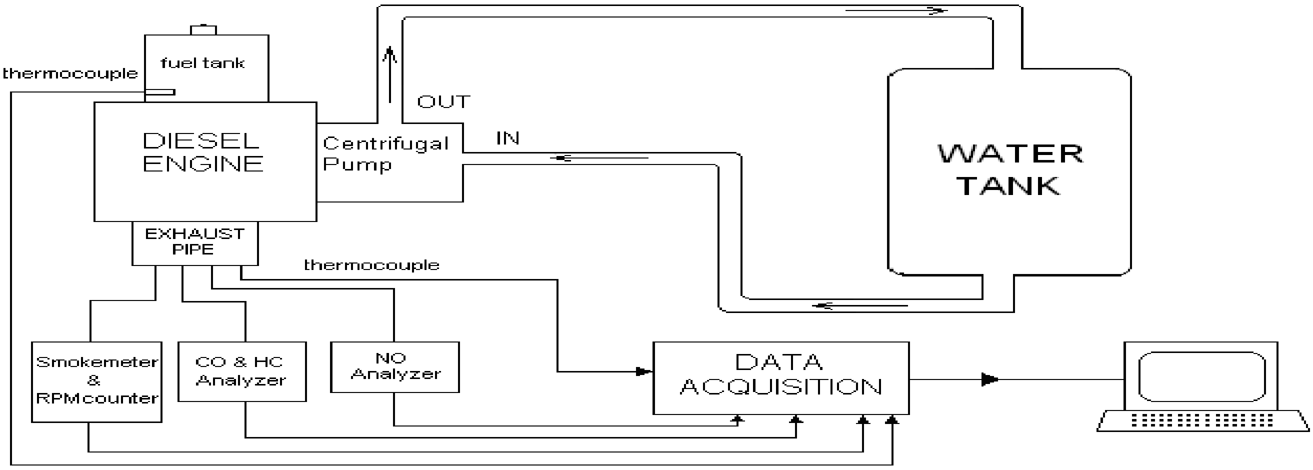
The major issue is how a four-stroke diesel engine behaves on the side of pollutants and operation, when it uses mixed fuel of diesel –maize oil.

II. INSTRUMENTATION AND EXPERIMENTAL RESULTS

In the experiment stage has been used directly maize oil in the mixture of diesel in to a four – stroke diesel engine. Specifically it has been used diesel, mixture diesel-5% maize oil (k5), diesel-10% maize oil (k10), diesel-20% maize oil (k20), diesel-30% maize oil (k30), diesel-40% maize oil (k40), Diesel-50% maize oil (k50) 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.

During the experiments, it has been counted:

- The percent of (%) (CO)
- To ppm(parts per million) HC
- To ppm(parts per million) NO
- The percent of smoke
- The supply of water
- Fuel consumption



Picture1. 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. The experimental results are shown at the following tables and figures:

	CO %						
rpm	**diesel**	**k5**	**k10**	**k20**	**k30**	**k40**	**k50**
1000	0,0289	0,0310	0,0309	0,0309	0,0319	0,0397	0,0345
1500	0,0303	0,0302	0,0304	0,0311	0,0345	0,0211	0,0288
2000	0,01	0,0280	0,0232	0,0284	0,0274	0,0281	0,0219
2500	0,0350	0,0244	0,0317	0,0296	0,0324	0,0305	0,0292

Table 1. The CO average value variation on different rpm regarding to the mixture.

	HC(ppm)						
rpm	**diesel**	**k5**	**k10**	**k20**	**k30**	**k40**	**k50**
1000	2,535	14,937	6,244	10,326	3,406	5,358	9,167
1500	13,31	21,485	9,236	17,997	14,718	0,449	17,197
2000	7,131	3,184	13,970	15,965	8,402	8,502	12,913
2500	10,961	16,347	18,884	23,556	30,551	7,451	17,712

Table 2. The HC average value variation on different rpm regarding to the mixture.

rpm	NO(ppm)						
	diesel	k5	k10	k20	k30	k40	k50
1000	518,210	771,001	696,827	495,603	380,361	349,140	207,760
1500	739,366	754,126	913,037	771,607	723,381	872,06	582,908
2000	762,155	834,334	520,485	760,936	839,268	928,337	720,505
2500	795,461	946,349	518,287	710,402	864,585	674,432	847,835

Table 3. The NO average value variation on different rpm regarding to the mixture.

rpm	%smoke						
	diesel	k5	k10	k20	k30	k40	k50
1000	3,262	12,722	7,301	7,488	16,623	7,200	26,232
1500	7,100	10,924	5,487	6,547	14,850	12,141	24,035
2000	5,688	18,679	4,001	6,588	9,936	14,071	18,884
2500	29,006	28,282	21,848	15,730	17,579	13,438	14,265

Table 4. The %smoke average value variation on different rpm regarding to the mixture.

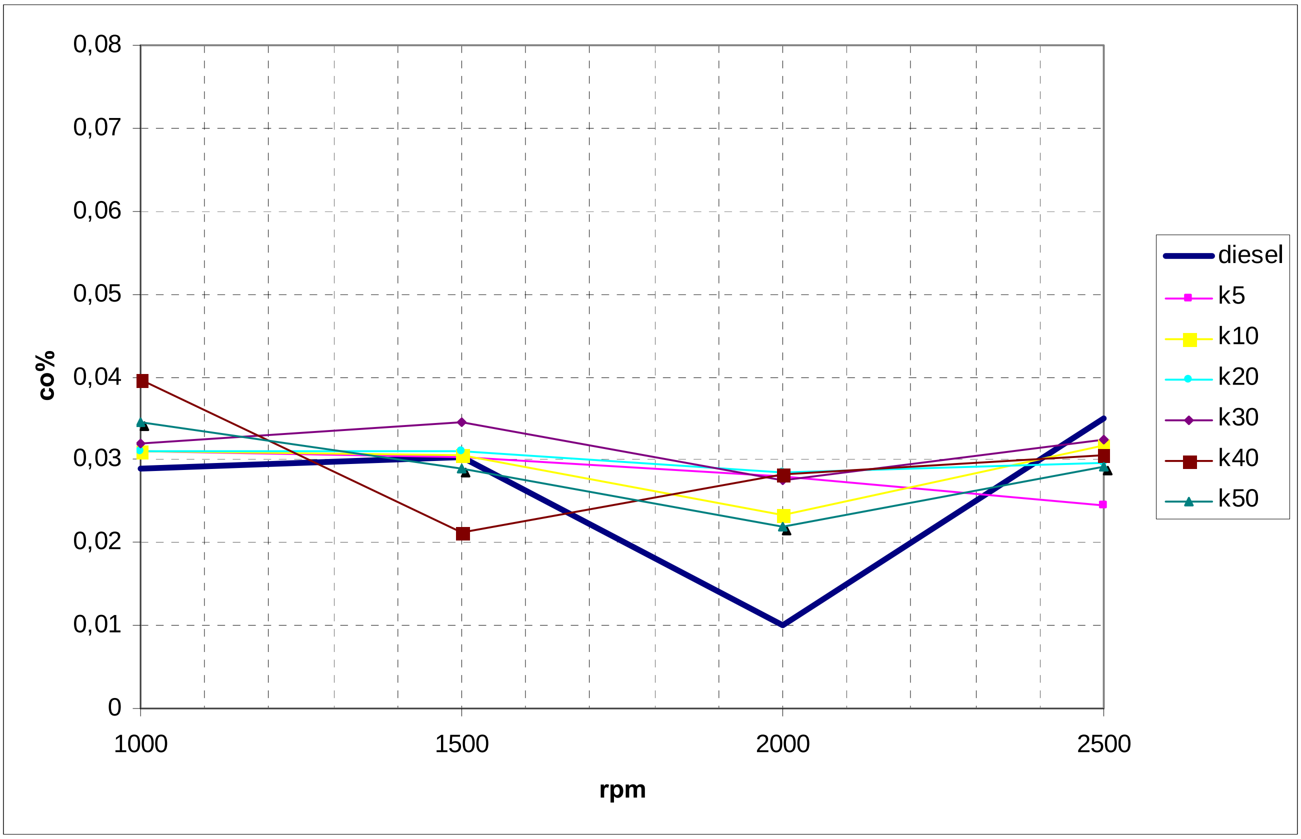


Figure 1. The CO variation on different rpm regarding to the mixture

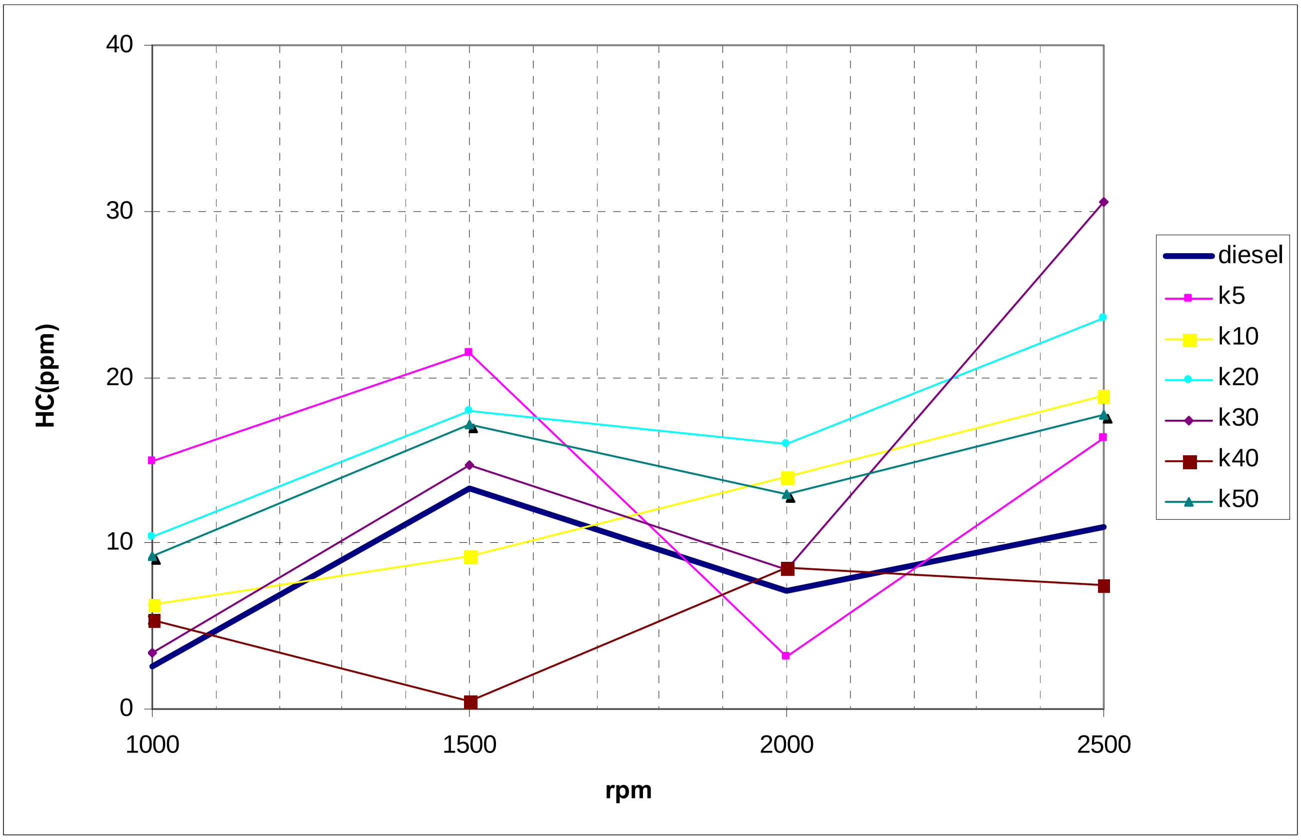


Figure 2. The HC variation on different rpm regarding to the mixture

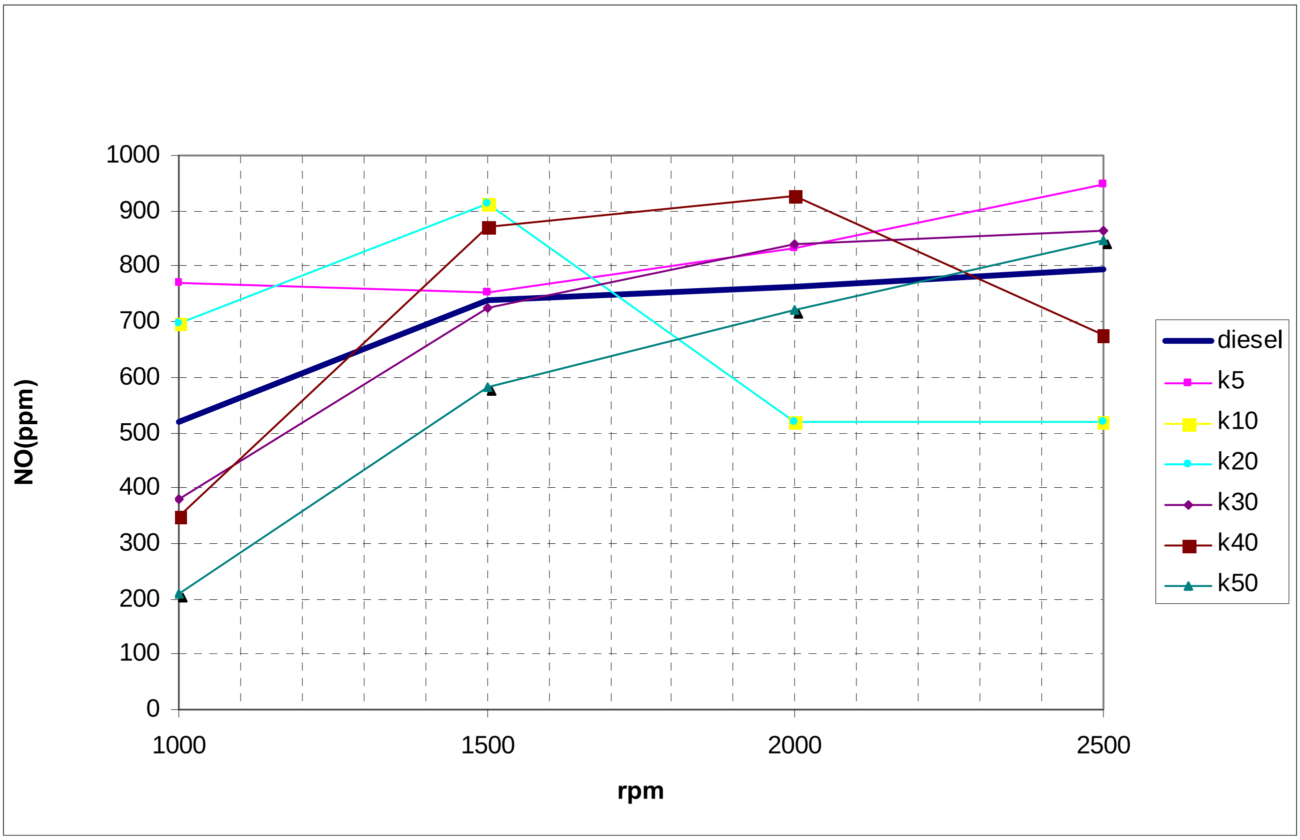


Figure 3. The NO variation on different rpm regarding to the mixture

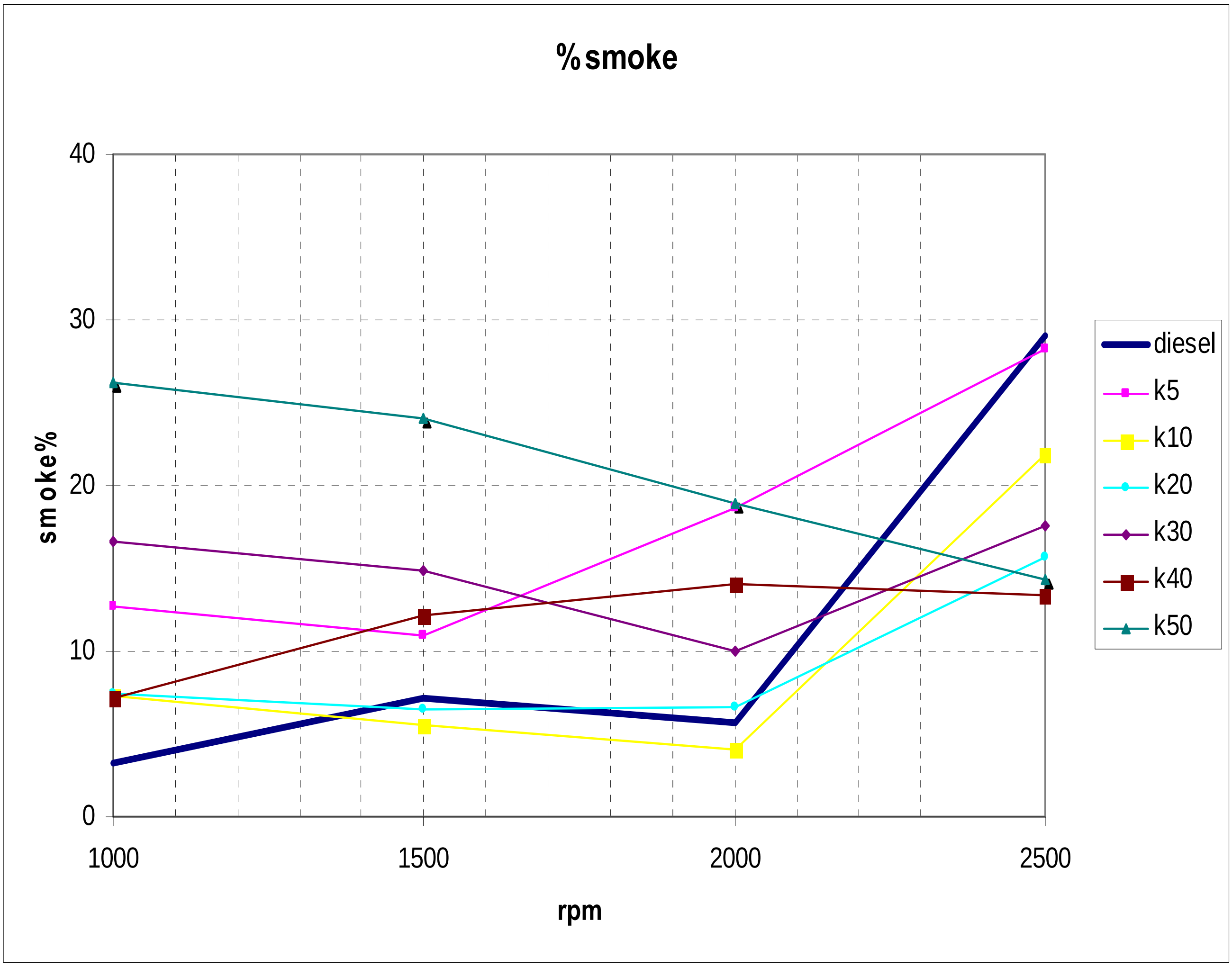


Figure 4. The smoke variation on different rpm regarding to the mixture

From the following table, it can be seen that the temperature of exhaust is not been influenced by the type of mixture of fuel.

	Exhaust gas temperature (°C)						
rpm	**diesel**	**k5**	**k10**	**k20**	**k30**	**k40**	**k50**
1000	102,2631	100,4652	82,87573	107,3048	88,5759	108,4994	108,6791
1500	133,4814	133,6283	129,2009	138,3753	129,3665	133,7456	138,4606
2000	180,4922	181,8127	184,5975	182,5919	181,6193	183,6106	186,1843
2500	211,2139	212,2143	212,6543	210,9876	210,2123	213,8765	211,6734

Table 5. The exhaust gas temperature (°C) on different rpm regarding to the mixture.

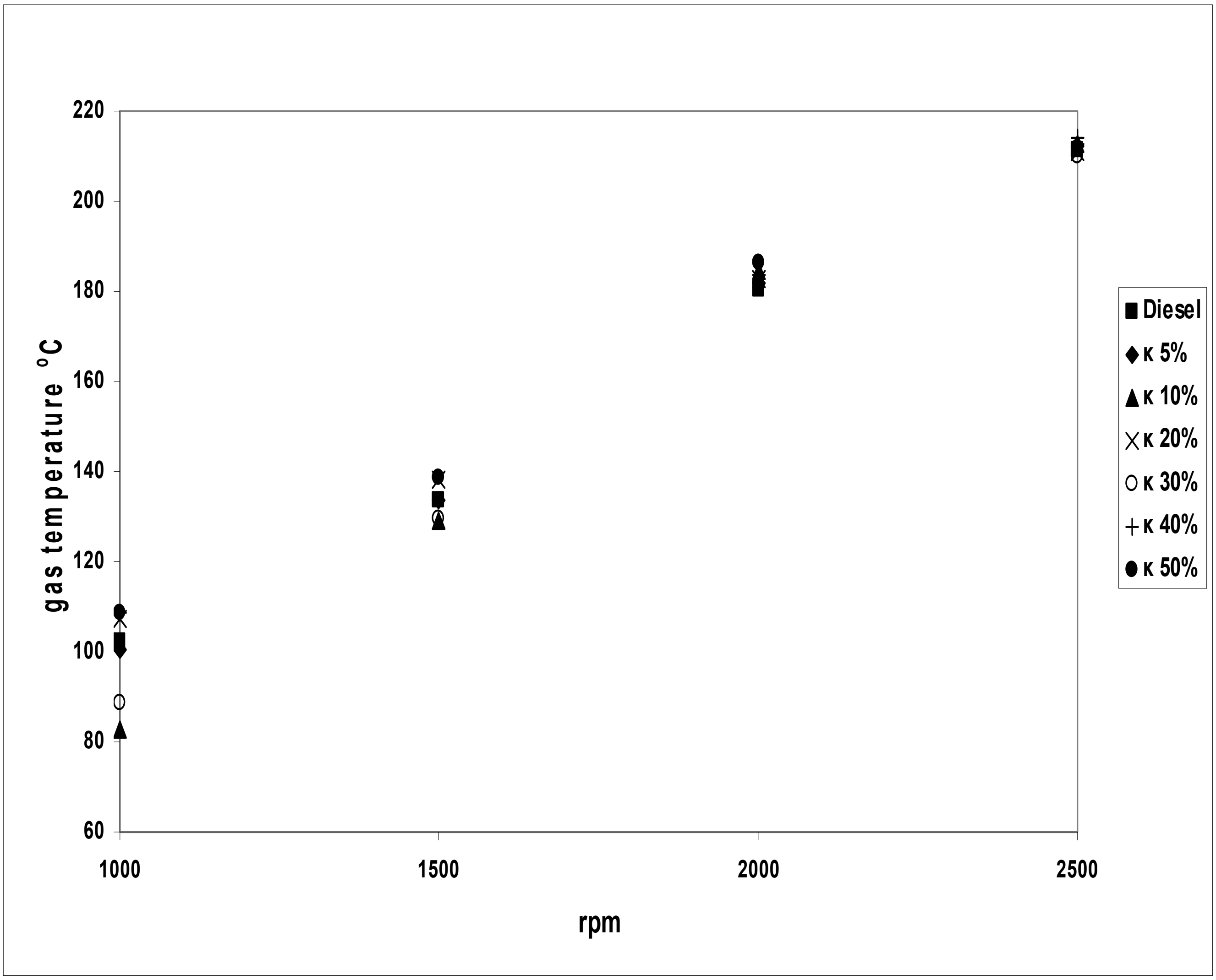


Figure 5. The exhaust gas temperature (^oC) variation on different rpm regarding to the mixture

From figure 1 it is clear that when the maize oil is increased on the fuel regarding to diesel, it appears an increase of CO, except in the case k40/1500rpm. From figure 2 it can be noticed the biggest reduction of HC regarding to diesel in case of k40/1500rpm. From figure 3 it can be noticed the biggest reduction of NO regarding to diesel in the case of k20/2000-2500rpm. From figure 4 it can be noticed the biggest reduction for k10/1500-2000rpm. From the above figures it is clear that the use of different mixtures can constitute changes to CO, HC, NO and smoke too. It is also important the fact that there was no changes in the rounds of the engine, as well as in the supply of water at the use of mixtures. Finally as far as the consumption is concerned, did not observed changes with the use of different mixtures.

III. Conclusion

The use of mixture of diesel and maize oil has the following impacts:

- About CO it can be noticed that when the maize oil is increased on the fuel regarding to diesel, it appears an decrease of CO, except in the case k40/1500rpm.
- About HC it can be noticed the biggest reduction of HC regarding to diesel in case of k40/1500rpm
- The biggest reduction of NO regarding to Diesel is noticed in the case of k20/2000-2500rpm.
- The smoke it can be noticed the biggest reduction for k10/1500-2000rpm
- The temperature of exhaust gases is not influenced by the type of mixture of fuel.

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