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The impact of alternative fuel on diesel in reducing of pollution from vehicles

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Abstract

The main source of energy for vehicles is currently internal combustion engines. These engines emit the main pollutants carbon oxide, carbon dioxide, hydrocarbons, nitrogen oxides, and particles matters into the atmosphere. The biggest polluter of nitrogen oxides and particles are diesel engines. For this purpose, the addition of alternative fuels ethanol, methanol, biodiesel, and Fisher-Tropsch fuel to conventional diesel fuel in the amount of 5-15% has been studied, to see their impact on the reduction of carbon dioxide and pollution. For this, the analytical method of carbon dioxide calculation, experimental data from the literature and experimental measurements of the opacity coefficient were used. From the obtained results, it results that in reduction of CO_2 affect more the fuels B15 up to 11.5%, M-15 up to 9%, FT 15 up to 7.5% and E-15 up to 6%. Also, M 15 has the greatest impact on the reduction of particles and nitrogen oxides with a reduction of 45% and 30% respectively, followed by E 15 with 30% and 20% and B15 and FT15 with 30% and 25%. Experimental measurements of the opacity coefficient confirm that the use of M15 and E15 fuels reduces pollution by 35% and 25%.

1. Introduction

In recent years, it has been determined that the acceptable limit of the level of carbon dioxide without causing serious consequences for the environment is 450 ppm [1], while if the limit value of 750 ppm is exceeded, we will have an irreparable environmental crisis, which is thought to be reached around the 2100 year, if this rate of carbon dioxide production continues.

Several studies have determined that in order to cope with the energy needs of an ever-growing population, energy needs will double in 2040, triple in 2070 and quadruple in 2100. The result of this forecast indicates an increase of over 300% of carbon dioxide gas in the atmosphere [2].

At the world level in 2014 year, over 30 billion tons of carbon dioxide were produced, of which 45% comes from the production of electricity and 18% from transport [3].

In 2012, there were over 1 billion vehicles operating worldwide. This number is expected to double in 2050. In Albania at the end of 2022 year, the number of cars reached over 588,000 vehicles (Less than 5% are hydride and electric vehicles).

In the EU, 250 billion euros are spent every year on the fuels used by cars. In the EU, the transport sector is 98% dependent on oil. The consumption of mineral oil is increasing and in the coming years it is expected to decrease and become more expensive

In vehicles are mainly used conventional fuels consisting of hydrocarbons, extracted from fossil oil from underground. Thus, from the use of these hydrocarbons by vehicle engines, carbon dioxide and other polluting gases such as carbon oxide, hydrocarbons, nitrogen oxides and carbon particles are released into the atmosphere. Carbon dioxide previously it was considered harmless to man, but in recent years after 2010 year, it is considered dangerous for the destruction of the atmosphere, because it affects the global warming of the atmosphere. Of the two types of engines used in vehicles, diesel engines have a higher pollution rate than electric ignition engines, because they release high amounts of nitrogen oxides and carbon particles PM into the atmosphere. Nitrogen oxides gases affect the greenhouse effect of the atmosphere, but also in human health, while carbon particles PM affect human lung damage and cancer [4].

There is no doubt that the use of vehicles in the transport sector will continue for a long time. Studies show that there is no doubt that the internal combustion engine (ICE) will be the main propulsion technology for road transport for a long time [5].

In these conditions, we must seek to find alternative fuels, to replace the use of gasoline and diesel, as derivatives extracted from crude oil. At the same time, alternative fuels should reduce emissions of harmful gases (NO_x, PM particles), as well as reduce carbon dioxide emissions.

In this direction, there are many studies on the use of alternative fuels in internal combustion engines of vehicles with a focus on reducing the level of pollution and of carbon dioxide. This is how the experiments of using many fuels that produce less carbon dioxide and harmful nitrogen oxides and carbon *particles* PM emissions continue. Even the use of hydrogen in hydrogen engines is an alternative of the future. But the use of these alternative fuels requires internal combustion engine designs changes, or modifications in the feed system, etc. [6].

The practical interest for the automotive industry is to find fuels that can be used in the current engine of vehicles (without making changes and modifications).

In this direction, biofuels constitute a stable central pillar. Studies and experiments have shown that the use of biodiesel in different mixtures with fossil diesel in diesel engines has technical stability, because the performance in terms of power, torque and specific consumption are close to conventional diesel. That's how it is mix biodiesel from 20% or more less or a level the low can be used as a direct replacement of petroleum fuel in all diesel vehicles without any engine regulation or system fuel [7, 8].

Also, from the use of biodiesel, it is observed that there is an improvement in the lubrication of the engine, which leads to a reduction in engine wear and extending the life of engine components.

In related with emissions, biodiesel reduces emissions net of the carbon dioxide with 78.45%, particles PM with 32%, carbon oxide with 35% and Sox with 8%, in compared with petroleum [6].

From the studies carried out [7] results that the density of smoke and carbon oxide emissions reduced with use of mixtures of biodiesel with petroleum in related with the petroleum, with one reduction, which is proportional to the growth of the percentage of biodiesel in this mixture.

Fisher Trophs synthetic fuels have also been used before, which have the same characteristics as diesel in terms of performance produced by the chemical industry, but also have the advantage of having low levels of nitrogen oxides and carbon particles pollution. Currently, they have high production costs and efforts are being made to reduce them.

Fisher Trophs synthetic fuels and biodiesel also have the advantage of not requiring new supply infrastructure, as they can be added to fossil fuels in a controlled manner.

To reduce the carbon dioxide produced by vehicles, it has been worked also in the direction of improving the construction of engines. Thus, we have carbon dioxide reductions from 190 g/km in 1996, to 180 g/km in 2000, to 150 g/km in 2005, to 140 g/km in 2012 and to 120 g/km in 2020.

In this regard, the International Energy Agency (IEA) also foresees the use of biofuels in transport vehicles, deciding that in the future these will not be alternative choices as they are currently, but a forced use of up to 5% in 2030. Thus, biofuel production is projected to increase from 250 million liters in 2015 to 430 million liters in 2030 [9].

In these conditions, the task of finding ways and methods to reduce the amount produced by vehicles of carbon dioxide and other main pollutants, nitrogen oxides and carbon particles is set.

In this direction, the mixtures of alternative fuels also serve us as a more possible way to increase the use of alternative fuels in the fuel market and to influence in the reduction of environmental pollution and global warming. In the direction of this problem, we have taken in the study the use of alternative fuels, which have little carbon in their composition, mixed with diesel fuel, in order to reduce the degree of pollution from carbon dioxide, nitrogen oxides and carbon particles.

So, in the use of fuels, it is necessary to compare the environmental impacts, but economic evaluations should also be made on the costs of their production as well as the state policies on their taxes.

To address the following problem, some knowledge will be given on diesel fuels currently used in vehicles and alternative and synthetic fuels.

2. Material and Method

For the realization of the study, the analytical method of calculating the carbon dioxide released by the fuels formed by the mixture of alternative fuels with fossil diesel during combustion in the engine was used, given by the experimental measurements taken from the technical literature, and the experimental measurements were performed for the degree of pollution caused by fuels formed during combustion in 3 cars with 3 different types of fuel systems.

2.1. Diesel fuels used in vehicles

The fuel that is commonly used in diesel engines is called diesel and it is a mixture of heavy hydrocarbons, which have a large molecular weight, with carbon atoms from 12-22, with boiling points from 149-399 °C. The fuel is burned in the engine by the process of self-ignition from the high temperature (over 700 C) that is created by the air pressure in the engine, which reaches 4800 kPa. An important place in this diesel composition is occupied by cetane with the chemical formula $C_{16}H_{34}$, which determines the cetane number, which is the main characteristic of diesel fuel, which is related to its auto-ignition time. Other main characteristics are density, which ranges from 0.83-0.86 kg/dm^3 and calorific value, which is 9500-10500 kcal/kg. Sulfur content, fluidity, cloud point and mechanical impurities are also important.

According to the molecular mass, 2 categories of diesel are used [10]:

Light diesel with chemical formula $C_{12.3}H_{22.2}$ with a molecular weight of about 170, which has a low viscosity and is easily injected, but is more expensive and is used in engines with high pressures, mainly in cars.

Heavy diesel with chemical formula $C_{14.6}H_{24.8}$ with a molecular weight of about 200, which has a greater viscosity and is injected with difficulty but is less expensive and is widely used in vehicles (mainly in trucks and heavy engines).

2.2. Compound fuels with additives to alternative fuels in fossil diesel

Alternative fuels are fuels that are not extracted from petroleum underground and are not paraffinic hydrocarbons, but are created by chemical processes of processing materials containing the elements C, H and O. The presence of oxygen helps in more complete combustion of fuel, increasing energy efficiency and reducing environmental pollution

In the idea of forming composite fuels, we relied on the E-diesel fuel experimented in the USA, which is a mixture of diesel with ethanol up to 15% by volume of ethanol. Adding ethanol lowers the cetane number and to increase the cetane number of E-diesel to the same as that of conventional fuel, additives must be added to the diesel. The calorific value is about 6% less than conventional fuel, but pollutant emissions are lower. Carbon particles are reduced by over 40%, carbon monoxide by 20% and nitrogen oxides by 5% [10].

With this rationale, we have created several fuels consisting of a mixture of diesel with the alternative fuels ethanol, methanol, biodiesel and Fischer-Tropsch, in a percentage of 5%, 10% and 15%, which we named with the brands: E-5, E-10, E-15; M-5, M-10, M-15; B-5, B-10, B-15 and FT-5, FT-10, FT-15. The first two alternative fuels ethanol and methanol are intended for engines with electric ignition and have a high octane number, as a result they affect the reduction of the cetane number, but have the advantages of reducing carbon dioxide, carbon oxide and nitrogen oxides gases. In additions of alternative fuels, we have stopped up to 15%, so that their use in diesel engines does not damage the operation of the engine and does not require modifications in the engine and in the fuel system.

The alternative fuels used in the study have the following characteristics [10]:

a) Ethanol is known as ethyl alcohol or wheat alcohol, is a chemical compound with the formula C_2H_5-OH. Ethanol has a calorific value of 6400 kcal/kg, lower than diesel, but has a very high octane value of around 113. Its combustion requires less air than diesel and releases fewer polluting emissions.

b) Methanol, known as methyl alcohol, or wood alcohol, is a chemical compound with the formula CH_3-OH. Methanol has a low calorific value of 4200 kcal/kg, but has a very high octane value of around 110. Its combustion requires less air than diesel and releases fewer polluting emissions. Methanol production can be derived from natural gas and biomass.

c) Biodiesel fuels, or biodiesel is a renewable fuel that can be produced from vegetable oils, animal fats, or recycled restaurant fats. Its characteristics are in accordance with the specifications of the standards for use in diesel engines. Biodiesel is a clean fuel, which does not release polluting emissions during combustion. Biodiesel also has a high cetane number, which helps in the smooth operation of the diesel engine. Meanwhile in the cold weather, the difficulty of starting the engine does not exist.

The creation of carbon dioxide (calculated from carbon dioxide produced by plants, produced biodiesel and released into the atmosphere) is almost 4 times less than conventional diesel [7 ,11].

In practice today, biodiesel combinations are used, which represent its mixture with diesel, such as B20 (20% biodiesel, 80% diesel). Biodiesel in its pure form (B100), requires certain engine modifications to avoid maintenance and performance problems [8]. Biodiesel costs more than conventional diesel often called petrodiesel.

d) Fischer-Tropsch synthetic fuels are produced from fossil products or biomass using carbon oxide (CO) and hydrogen extracted in a process similar to hydrogenation, producing gasoline and diesel. They have the same characteristics and performance as petrodiesel (44 MJ/kg) and burn cleanly, reducing the level of greenhouse gases of carbon oxide and nitrogen oxides to 80%, carbon dioxide to 50% and carbon particles (PM) to 20-50%.

[10]. Fischer-Tropsch diesel has a high cetane number (NC=74) and can be mixed with diesel in any ratio and used without any engine modification, improving combustion and greatly reducing environmental pollution. Currently, Fischer-Tropsch fuels are expensive to produce in large quantities and the research continues to reduce the cost of processing.

The use of alternative fuels in vehicle engines is related to several main factors, which are:

- Increasing demand for fuel for vehicles and decreasing global reserves of fossil diesel, which will lead to an increase in the price of diesel.
- Negative effects on environmental pollution and human health
- Negative effects on the creation of greenhouse gases and global warming of the earth

In the EU Green Paper, the Commission has proposed as a target by 2020 to replace 20% of the automotive fuel market with alternative fuels (10% natural gas, 5% biofuels and 5% hydrogen [12], but nothing has been applied so far in Albania.

2.3 Estimation of the amount of carbon dioxide released by the burning of fuels

To determine the amount of carbon dioxide, we will use the equation of the chemical reaction of fuel combustion [13], which we will use for mixing. Thus, we have:

a) For diesel

In the study we are taking the second most used category. The combustion process will be expressed by the Equation 1:

$$C_{14.6}H_{24.8} + 20.8\ O_2 + N_2 = 14.6\ CO_2 + 12.4\ H_2O + N_2 \tag{1}$$

So, during the burning of 1 kg diesel, will be released: 14.6x44/200 = 3.21 kg CO_2.

b) For ethanol

The combustion equation of pure ethanol is expressed as (Equation 2):

$$2C_2H_5{-}OH + 6O_2 + N_2 = 4CO_2 + 6\ H_2O + N_2 \tag{2}$$

So, during the burning of 1 kg ethanol, are released: 4x44/2x46=1.91 kg CO_2.

c) For methanol

The combustion equation of pure methanol is expressed as (Equation 3):

$$2C\,H_3{-}OH + 3O_2 + N_2 = 2CO_2 + 4H_2O + N_2 \tag{3}$$

So, during the burning of 1 kg methanol, are released: 2x44/2x32=1.37 CO_2.

d) For biodiesel

Pure biodiesel (B100) during combustion releases 4 times less carbon dioxide than diesel [6], so it releases 0.8 kg CO_2.

e) For Fischer-Tropsch synthetic fuels

Clean fuel (FT100) during combustion releases 50% of the CO_2 of diesel [11], thus releasing 1.6 kg CO_2. Composite fuels represent additions of 5%, 10% and 15% of alternative fuels to fossil oil, therefore the amount of Carbon dioxide released by burning 1 kg of composite fuel will be calculated (Equation 4):

$$G_{CD} = G_K \times P_i + G_D \times P_i' \tag{4}$$

Where:

G_K – The amount of carbon dioxide produced by the complete alternative fuel, obtained from the above estimates a, b, c, d, e.

G_D - The amount of carbon dioxide produced by the second type of oil, obtained from Equation (1).
P_i - The percentage that the alternative fuel occupies in the composite fuel,
P_i' - The percentage of diesel in the composite fuel.
The results of the calculations performed for the composite fuels are shown in Table 1 and graphically in Figure 1.

Table 1. Amount of Carbon dioxide from 1 kg mixed fuel.

Fuel type	G_k	Pi	Pi'	Amount of Carbon dioxide
Diesel	3.21	0	1	3.21
E-5	1.91	0.05	0.95	3.195
E-10	1.91	0.10	0.9	3.07
E-15	1.91	0.15	0.85	3.02
M-5	1.37	0.05	0.95	3.1
M-10	1.37	0.10	0.9	3
M-15	1.37	0.15	0.85	2.92
B-5	0.8	0.05	0.95	3.08
B-10	0.8	0.10	0.9	2.96
B-15	0.8	0.15	0.85	2.84
FT-5	1.6	0.05	0.95	3.12
FT-10	1.6	0.10	0.9	3.04
FT-15	1.6	0.15	0.85	2.96

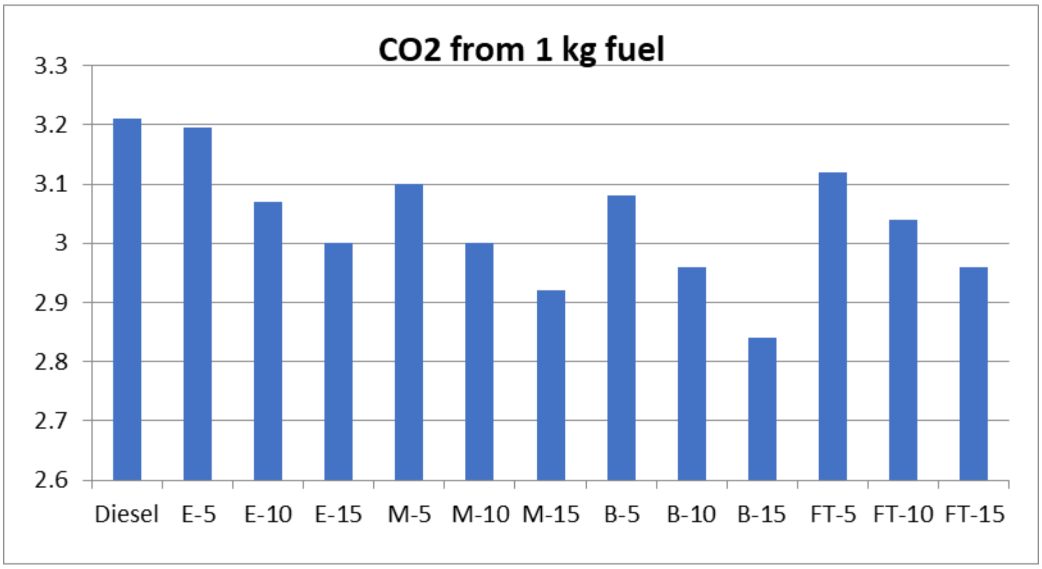

Figure 1. Amount of carbon dioxide for brands of formed fuels.

2.4. Experimental determination of the level of pollution from formed fuels

For vehicles with diesel engines, the degree of pollution is assessed by the opacity coefficient, which indicates the degree of turbidity caused by the combustion gases escaping into the atmosphere. The main place in this turbidity is occupied by carbon particles (PM particles and nitrogen oxides).

For this reason, the measurement of the opacity coefficient is used to assess the degree of pollution of vehicles with diesel engines, for which criteria have been set that must be met by the vehicles to be allowed for circulation. [14].

Thus, in order to confirm the efficiency of the above fuels in reducing carbon particles in the case of fuel brands with ethanol and methanol, experimental measurements of the opacity coefficient were performed at the vehicle technical control center. For this, 3 vehicles with diesel engines were taken with the 3 types of fuel systems used in diesel engines, and specifically:

A. Car: Mercedes Benz; type- 202; commercial type - C250; year of production -1995, Engine working volume -2497 cm3; Number of cylinders - 5; Fuel system with linear high-pressure pump (with 5 pumps). Regular technical condition, before experimentation, it has done 244,000 km.

B. Car: Mercedes Benz; type - 168; commercial type - A170CDI; year of production -1999, Engine working volume -1689 cm3; Number of cylinders - 4; Common rail fuel system (high pressure pump). Regular technical condition, before experimentation, it has done 210,000 km.

C. Car: Ford; type - GAYA; commercial type - Fiesta; year of production -1997, Engine working volume -1753 cm3; Number of cylinders - 4; Fuel system with rotary high-pressure pump (with one pump). Regular technical condition, before experimentation it has done 24600 km.

To measure the pollutant level of the gases coming out of the exhaust tub, the electronic Odometer device was used, which is used to measure the pollutant level of vehicle gases during the technical control by SGS Automotive Albania [15]. According to directive of the Ministry of Public Works and transport for the technical control of vehicles [16] and the CE directive 40/2009/ [17], for diesel engines only the smoke opacity coefficient is measured, as an adequate indicator of vehicle maintenance conditions, in relation to emissions of gases.

To perform the tests for measuring the opacity coefficient, the following methodology is followed:

The normal working temperature of the vehicle engine is ensured, then the data of the vehicle to be tested (engine type, fuel type, cylinder capacity, year of manufacture) are entered into the odometer computer and the measurement sensor is placed in the exhaust pipe. After that, the engine is accelerated up to 80% of maximum engine speed. According to the standard test with a german program, the green area of the engine revolutions (over 2500 rpm) appears on the monitor, which must be tested. The test is performed 3 times and the program itself outputs the average value of the 3 tests. Meanwhile, the minimum and maximum engine speeds are determined.

The experimental tests were performed for the three vehicles given according to the above methodology, once for diesel fuel and 6 times for mixed fuels: E-10, E-10, E-10, M-10, M-10, M-10,
During experimentation, the tests showed that the use of E-15 and M-15 fuel in the case of the car Benz 170 CDI vehicle cannot be used, because it disrupts the normal operation of the engine by creating high pressure before the PSV, which at low and medium speeds causes injector movement. So, in this case the mixture can be used up to 10%. While in the other 2 cases, the evidence showed that these fuels can be used without problem.

The results of the measurements of the opacity coefficient for the 6 fuels of ethanol and methanol mixtures taken in the study are shown in table 2 and in fig 2

Table 2. Values of opacity coefficient for the 6 mixed fuels.

Fuels	Benz C250D	Ford Fiesta 1.8D	Benz 170D
Petrodiesel	2.6	3.4	3
E-5	2.3	3	2.7
E-10	1.9	2.5	2.4
E-15	1.5	2.1	2
M-5	3.2	3	2.6
M-10	1.8	2.4	2.3
M-15	1.3	2	1.9

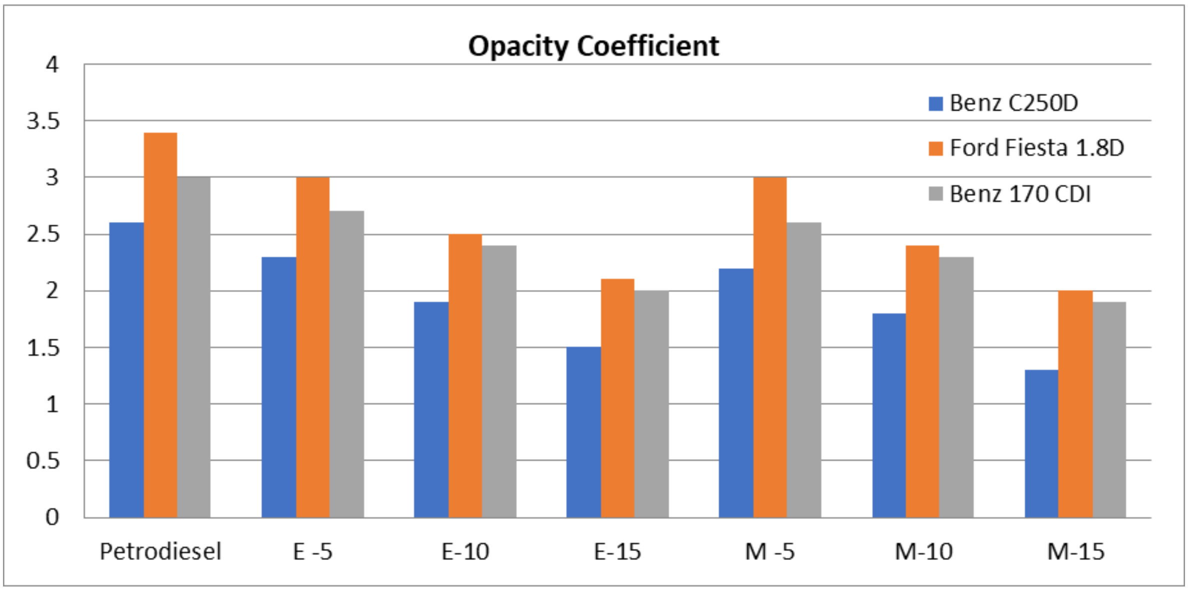

Figure 2 Opacity coefficients for the 6 fuels formed with alternative fuels.

3. Calculation of the amount of carbon dioxide at an intersection

In the study, we took the intersection "21 Dhjetori" in the city of Tirana in Albania (fig3), for which the average number of vehicles circulating in a traffic light cycle of 1.5 minutes from 07.00-21.00 for a working day shown in fig. 4. From figure results that at this intersection, on average, circulate in one cycle Nc=104 vehicles. The number of vehicles per hour Nh is determined (Equation 5):

$$Nh = Nc \times 60 / Tc \qquad (5)$$

From the equation it follows that in one hour 4150 vehicles circulate in the intersection, while in one working day circulate 4150x15=62250 vehicles.

For the average consumption of fuel in the city, we will accept that car moves at the intersection at a speed of 25 km/h. We will accept that for the economic speed of 50-60 km/h, a car consumes about 5 kg/h (for 20% of the engine power), for the speed of movement in the city (25 km/h) we will accept an average consumption 2.5 kg/hour.

Figure 3 The intersection "21 Dhjetori".

Thus, the amount of carbon dioxide per one hour released by vehicles at the intersection using different fuels can be determined (Equation 6).

$$G_{CO2} = g\, G_{CD}\, K\, Nh \quad [Kg/h] \qquad (6)$$

Where:
g – average fuel consumption in one hour
G_{CD} – the amount of CO_2 released from the formed fuel in one hour, which is taken from Table 1.
K- Coefficient of calorific power of the fuel compared to diesel, for which K=1
Nh- Number of vehicles circulating per hour, according to Equation (5).

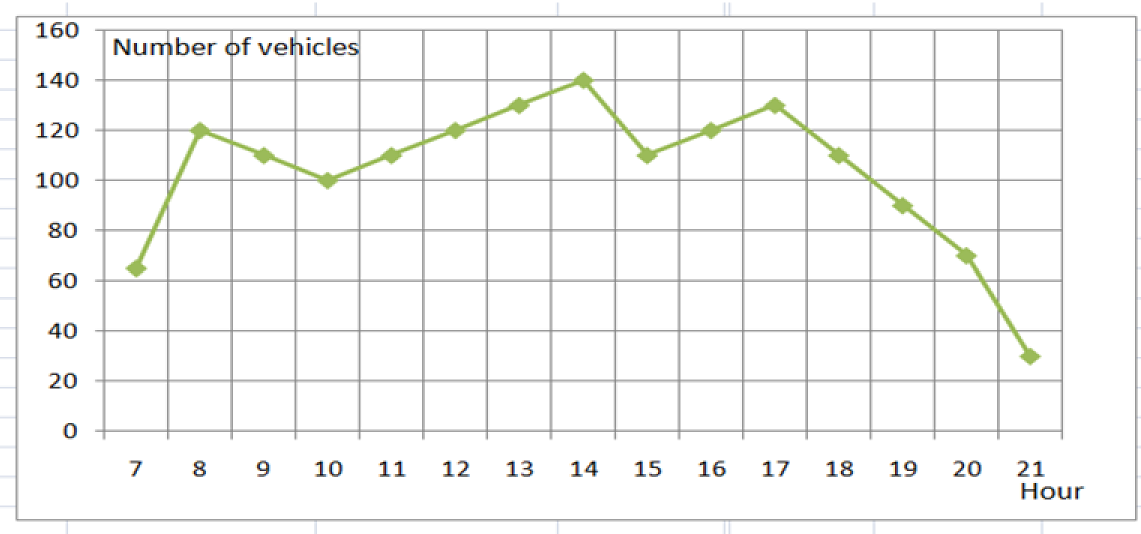

Figure. 4 Number of vehicles in the intersection for a cycle Nc.

In the registration of vehicles, it results that around 90% of the vehicles [13] are with diesel engines. We will assume that all vehicles have a diesel engine. In fact, for the same power, the engine consumes ethanol and methanol 20% more, because they have a lower calorific value than diesel. Therefore, in the case of ethanol and methanol, the consumption coefficient is 20% higher.

The results obtained from the calculations made according to formula (6) for the considered fuels are shown in Table 3 and with the graphs in Figure 5.

Table 3. The amount of Carbon dioxide released in the city for one hour for the fuels formed.

Fuel type	G_{CD}	K	g	Amount of Carbon dioxide
Diesel	3.21	1	2.5	33304
E -5	3.195	0.64	3	27502
M-5	3.1	0.42	3	17511
B-5	3.08	1	2.5	31955
F-T 5	3.12	1	2.5	32370
E-10	3.07	0.64	3	26426
M-10	3	0.42	3	17060
B -10	2.96	1	2.5	31125
F-T 10	3.04	1	2.5	30086
E 15	3.02	0.64	3	25996
M15	2.92	0.42	3	16496
B15	2.84	1	2.5	29465
F-T 15	2.96	1	2.5	30710

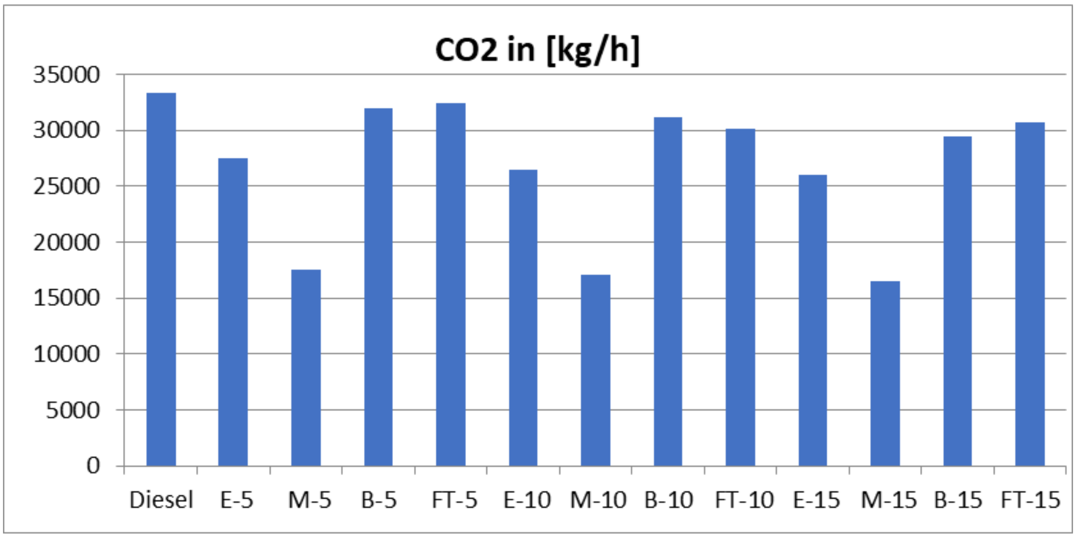

Figure 5. The amount of carbon dioxide released from fuels for one hour of traffic.

3. Results and Discussion

The results of the above calculations in Figure 1, show that ethanol produces 1.5 times less carbon dioxide than diesel, methanol 2.2 times less than diesel, biodiesel produces 4 times less than diesel, and Fischer-Tropsch fuel 2 times less than diesel.

While the results of the calculations for the amount of carbon oxide produced by the formed fuels show that of interest for practical use are the brands formed from the blends of biodiesel, Fischer-Tropsch fuels, methanol and ethanol, up to 15%, in diesel, which respectively achieve a reduction of carbon dioxide up to 11.3%, 8%, 9% and 6.5%.

Based on the experimental studies carried out for E-15 diesel [10], it results that the use of the proposed brands in vehicles ensures a relatively high reduction of nitrogen oxides gases and PM particles. Thus, the use of B-15 reduces nitrogen oxides and PM particles up to 30%, the use of FT-15 fuel reduces nitrogen oxides up to 20% and PM particles up to 25%.

Whereas the use of fuel M-15 (diesel with methanol) reduces PM particles by about 45% and nitrogen oxides (NO_x) by up to 30%, while E-15 ethanol fuel reduces PM particles by about 25% and nitrogen oxides by up to 20%. Fuels with ethanol and methanol make a clean combustion, due to the oxygen they have in their chemical formula and due to the lower calorific power, they make a decrease in the temperature in the combustion chamber, which affects the reduction of the creation of nitrogen oxides. Meanwhile, these have the disadvantage of reducing the cetane number of the diesel, therefore in winter these fuels must be used with additives or Fischer-Tropsch fuel additions.

Also, biodiesel B20 [10] produces 25% less carbon dioxide than diesel, while E-10- 15%, but we also benefit from a pollution reduction of up to 40%. Fischer-Tropsch synthetic fuels produce 53% less carbon dioxide than petrol and 50% less than diesel, but they also have major advantages in reducing carbon oxide and nitrogen oxide emissions by up to 80% and reducing PM particles by up to 50%. So, the impact on reducing greenhouse gases for global warming is doubled

The results of the experimental measurements shown in Figure 3 show that brands of fuel from the mixture of diesel with ethanol and methanol above 10% provide us with a significant reduction in the degree of pollution.

Thus, for the 2 vehicles that do not have a common rail fuel system, Benz C250D and Ford Fiesta 1.8D, fuel M-15 reduces pollution by up to 35% of the opacity coefficient, while E-15 fuel with 15% ethanol addition reduces pollution up to 25%.

Based on the above results, we propose that for the reduction of carbon dioxide, nitrogen oxides pollutants and PM particles produced by diesel engine vehicles, diesel fuel blends with 10 to 15%. Biodiesel, Fisher-Trophs, methanol and ethanol, either and in the experimental phase, because this provides us with a total reduction of greenhouse gases (CO_2) up to 11.5%, but also a significant reduction of environmental pollution from PM particles by around 30-45%. Application of biodiesel and Fischer-Tropsch in percentage higher will be used, when the cost of their production is reduced to the levels of the diesel cost.

Due to the high impact of these fuels on the environmental impact from the EU and the US, today the implementation of Fischer-Tropsch fuel Diesel production lines is being requested perfecting the technology in order to reduce the cost [18].

To enable the use of the above fuels in transport vehicles, with the aim of reducing carbon dioxide and reducing pollution, the government should encourage fuel supply companies by issuing decisions that remove customs taxes and other excises, which these fuels are introduced to the market and mixed fuels with diesel are traded. A similar experience can be taken by the Italian government with the issuance of Law no. 81 dt. 11.03.2006, which imposes on fuel companies the obligation that the fuels sold at supply pumps contain biodiesel starting from 1% on 31.12.2005 to 5.75% on 31.12.2010, which will then increase.

From the use of alternative fuels in cars with diesel engines during city traffic in one hour (Table 3) it results that from the use of B-15 we benefit a reduction carbon dioxide of 3840 Kg per hour, or a reduction of 11.5% compared to the use of diesel. While from the use of FT-15 fuel we have a reduction carbon dioxide of 2600 kg per hour compared to the use of diesel

From the use of M-10 and M15 in cars with diesel engines during city traffic in one hour (Figure 3) we obtain a decrease in production of carbon dioxide by 16300 -16900 kg per hour, or a decrease by 45% compared to the use of diesel. While using E-10 and E-15 we get a reduction of carbon dioxide production by 5900-6400 kg per hour, or a 20% reduction compared to the use of diesel. While using FT-10 fuel we have a reduction of carbon dioxide by 2600 kg per hour benefiting from a reduction of carbon dioxide from 50% compared to the use of diesel.

4. Conclusion

The use of Fischer-Tropsch diesel fuel in diesel vehicle engines achieves a reduction of carbon dioxide up to 2 times, the degree of pollution from nitrogen oxides up to 80% and from PM particles up to 50% compared to conventional diesel.

The use of B-15 biodiesel fuel in diesel vehicle engines achieves a reduction of carbon dioxide up to 11.5% and the degree of pollution from nitrogen oxides and carbon particles up to 30% compared to conventional diesel.

Use of FT 15 diesel fuel in diesel vehicle engines, achieves a reduction of carbon dioxide up to 7.5%, the degree of pollution from nitrogen oxides up to 25% and from carbon particles up to 30% compared to conventional diesel.

The use of M-15 and E-15 fuels in diesel vehicle engines achieves a reduction of carbon dioxide by 8.7% and 6%, respectively, and the degree of pollution by nitrogen oxides and PM particles up to 35% and 25% compared to conventional diesel.

In order to make it possible to reduce greenhouse gases and the level of environmental pollution from vehicles in Albania, the government must issue decisions to reduce customs taxes and make it mandatory for fuel import companies to use fuel mixed with biodiesel, Fischer-Tropsch, methanol and ethanol with 10-15%. , which are also used in developed countries.

By using biodiesel B15, we have a reduction of carbon dioxide in the intersection up to 3800 kg/hour or a reduction in pollution up to 11.5%, compared to conventional diesel. A special practical interest is the use of methanol in the mixture, where from the M-10 and M-15 fuel benefit a reduction of carbon dioxide up to 16900 kg/hour or a reduction up to 45% compared to conventional diesel.

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Author contributions

Asllan Hajderi: Conceptualization, Methodology, Writing-Original draft preparation, **Ledia Bozo:** Data curation, Software, Validation, **Fatmir Basholli**: Writing-Reviewing and Editing.

Conflicts of interest

The authors declare no conflicts of interest.

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