

# EMISSIONS CHARACTERISTICS OF TRACTORS DIESEL ENGINE FUELLED WITH THE BLENDS OF MINERAL DIESEL-BIODIESEL FUELS

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## 1. INTRODUCTION

Reduction pollutant emissions, especially NO<sub>x</sub> and PM, and CO<sub>2</sub> emissions has now a major driver for changes in automotive technology. It is fact that millions of dollars are currently being channeled in the direction to find ways to reduce CO<sub>2</sub> emissions, instead of to reduce the harmful PM and NO<sub>x</sub> emissions.

NO<sub>x</sub> emissions affect respiration, with the main component being NO<sub>2</sub>, which is heavy gas and not easily dispersed in the atmosphere. It means that people with existing health conditions are more vulnerable to further complications.

As for as particle matter emission the biggest problem is the size of it – below a certain mass we can ingest the particles into our lungs [1]. In essence, the lungs have a natural filtration system that keeps out the big lumps of carbon and soot quite well, but as the particles get smaller, they can be ingested and this cause problems for people who have respiratory and heart conditions. Some particle is fairly inert, but it can carry absorbed on to it, soluble organic fractions that are carcinogenic. Particles that cause cancer are in the order of 2,5 μm in size. It means that there will be further PM and NO<sub>x</sub> reductions levels (beyond those in Euro 6 proposals) –but in much smaller steps. There is likely to be a separate NO<sub>2</sub> limit, as this is a particularly harmful gas.

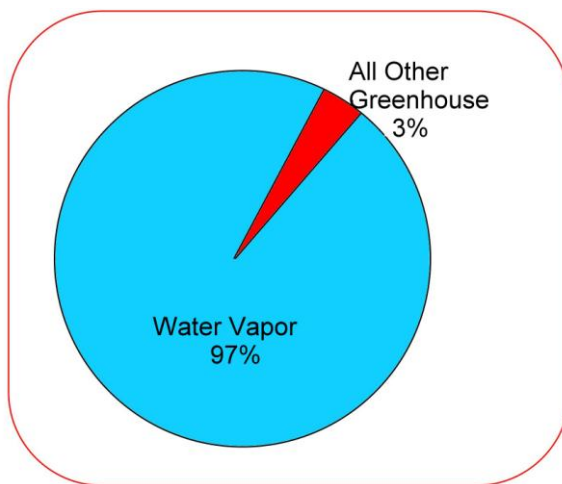
Therefore, what is needed from automotive legislations is a common sense approach to, first, create more-efficient vehicles, with a few not to reduce CO<sub>2</sub> emissions but to avoid unnecessary waste and thus prolong earth's resources, and second, for legislators to focus on emissions that are actually toxic, as in damaging to one's health.

It should be said that in nowadays, as in the past two decades the focus of world public debates is about climate change caused by human activities implied, with emphasis on road transport. Even though there is no scientific foundation for the implied and imposed on the public and keep repeating the claim that human activity caused the increase of CO<sub>2</sub> content, which can lead to catastrophic consequences on the eco-systems, all EU countries have adopted climate change as a major task in environmental protection. The main pillar of activity is trans-national Commission on Climate Change (IPCC), that the hypothesis of climatic changes in the last 100 years based on three indicators of potential greenhouse gas: CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O. Surprising that the potential of water vapor does not take into account,

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although it seems (60) -95% of greenhouse gases effect. CO<sub>2</sub> from human active times is only 3% of the natural flux (Fig. 1), and it, together with oxygen in the Earth's biosphere to participate in the metabolism of the planet depending on its absorption.



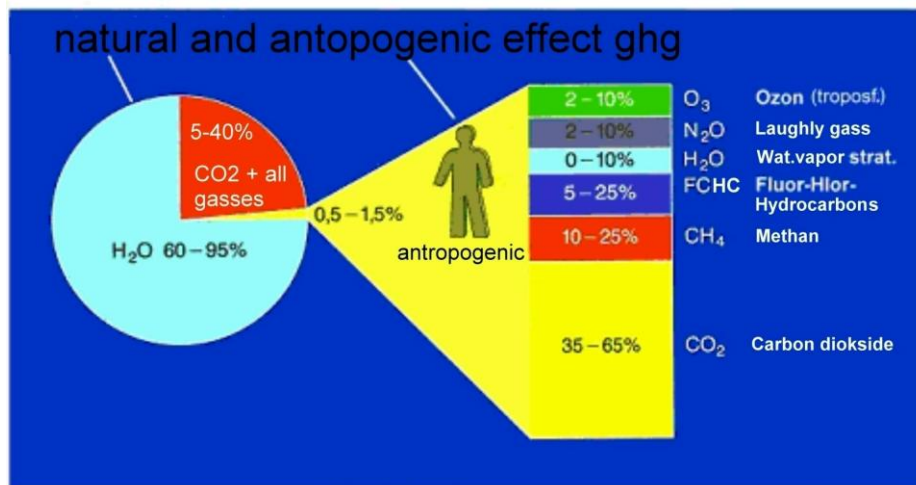
**Figure 1:** Composition of greenhouse gas [2]

It has been shown to increase from 200-1000 ppm CO<sub>2</sub> is beneficial for the growth of plants, particularly cereals and their use of water. This means that this level of CO<sub>2</sub> and higher, can not have adverse environmental effects. According to the opinion of the European Parliament's transport sector is a major emitter of carbon dioxide. Hence, this sector should be the starting point in preventing climate change. So the pressure is on the automotive industry, primarily to producers of passenger cars to reduce CO<sub>2</sub> emissions. Therefore the entire world road traffic (passenger and freight) contribute about 12% of global anthropogenic CO<sub>2</sub> emission and about 0.5% CH<sub>4</sub> emission [3].

Do you have launched and continuously spreading news about the catastrophic dangers of climate change due to global warming, as a consequence of human activities facts, possible facts, or fabrication depends on who chooses what to believe. In a campaign designed to market and political studies are included in all media, eco-lobbyists, politicians (eg. Tony Blair, Al Gore), many scientific institutions, the so-called independent intellectuals and scholars, who in their own interests causing major damage but not only science but and social progress in general, and the IPCC, as an advisory body of the United Nations, which is the main pillar of activity in the prevention of these conceived and launched catastrophic consequences of global warming as a consequence of anthropogenic activities increase in CO<sub>2</sub> emissions [4,5].

Hypotheses about the disastrous spread of risk by alarmism have no scientific basis, and are identical to intimidation of the people of pandemic influenza, which creates a powerful pharmacy industry and lobbyists.

The actual impact on the anthropogenic greenhouse effect is very small (~ 1%, Fig. 2).



**Figure 2:** Influence of natural and anthropogenic emissions of greenhouse structure [ 6 ]

Constant improvement of technology achieved a significant reduction of greenhouse gases in the exhaust emission cars, so that today a modern car that meets the EU-4 emission norms emits hydrocarbons, but 300 cars 40 years ago.

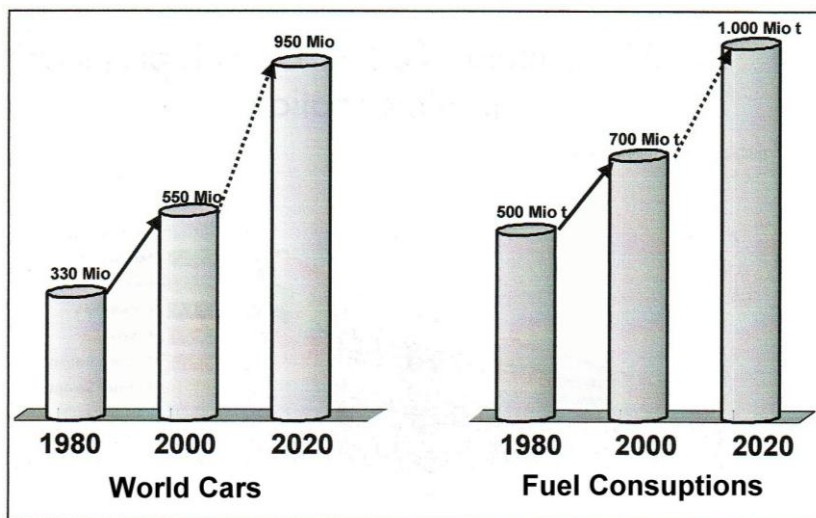
Claims that the car is responsible for climate change due to CO<sub>2</sub> emissions are unfounded, and political demands that reduction automotive CO<sub>2</sub> emissions, there is justification only from aspects fuel consumption i.e. rational primary energy consumption, since CO<sub>2</sub> emissions is directly proportional to fuel consumption. This means that the emission cars of 120g CO<sub>2</sub> / 100km, as prescribed by 2012., it will be appropriate fuel consumption of 4.5 to 5.0 l/100km.

It is clearly not only now in the era of the global financial crisis but also in the future, there will be no more cheap energy. The global energy crisis can be resolved only by a wave of innovation in all industries, especially in the automotive industry, which is the driving force of economy in developed countries. Innovation economy can only improve all aspects of human life, and new innovations can arise only as a result of scientific-research laboratories and scientists who are not in the service of politics and business lobbies, such as causing the most damage science and general social progress. Of course we needed a new much more honest and daring leaders, both in industry and in politics, who will be more respected scientific truth, but business lobby dictates, why in recent years eaten "living tissue" of the economy and created economic crisis.

Increase the number of vehicles in the world leads to a global increase in energy consumption (Fig. 3). The transport sector consumes about 30% of primary energy, and about 97% of transport fuels produced from oil.

In the coming period, the main guideline in the development of new automotive technologies are: 1) energy efficiency, 2) efficiency and reliability and 3) ecology. For realizing this big 'E' trilemma transport sector needs to develop a) vehicle improved energy

efficiency, b) alternative fuels and low emission engine oil [7], c) low-emission vehicles and low weight, d) intelligent transportation systems.



*Figure 3: Future the growth of car and fuel*

Alternative fuels are an opportunity for people to leave oil before it leaves them, i.e. to slow down the exploitation of mineral resources and slow down the forecasted end of the announcement, and to reduce emissions.

Alternative fuels, particularly from lignoceluloze i.e. II generation biofuels are a great opportunity for the world economy and a great opportunity to increase the employment[8,9].

## 2. EXPERIMENTAL

Tests of the effect of biodiesel and mineral diesel mixture on diesel exhaust emissions have been performed on a three cylinder tractors DI diesel engine (THDM 33/T~ TD 3.152 Perkins) of rated power 40.5 kW, 2250 R.P.M. swept volume 2.5 dm<sup>3</sup>, turbocharged KKK 14 with intercooler. The engine is an older design with an open combustion chamber in the piston, while nozzles have 4 holes with dia.0.28 mm each. Injection pressure is 210 bar and injection angle 12<sup>0</sup>. It is well known that the majority of investigations relating to the effect of fuel quality on diesel emissions are performed on engines of modern design that having considerably higher injection pressures and that have nozzles with greater number of holes.

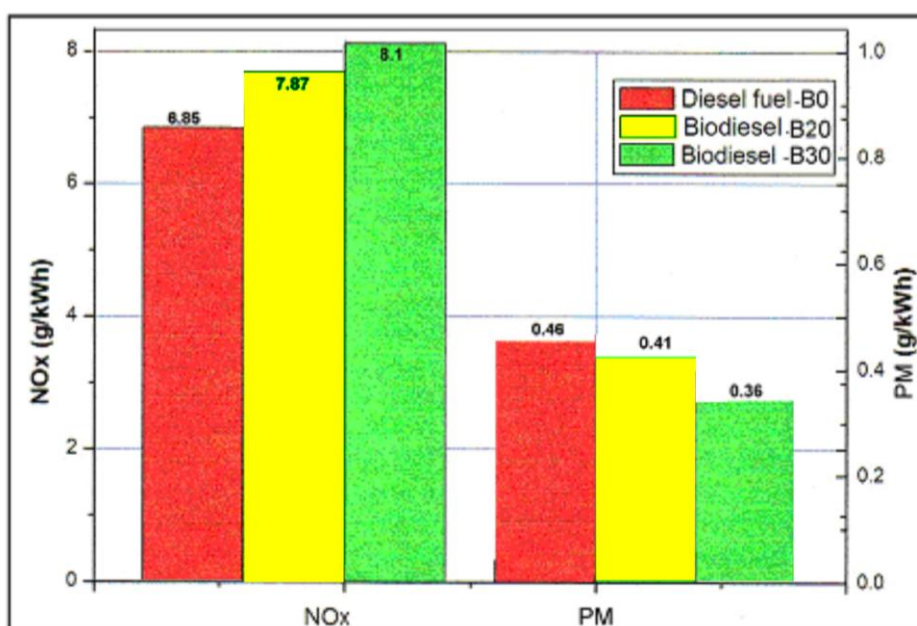
Three types of diesel fuel have been used in this study: 1) regular diesel fuel (according En 590:  $\rho=0.84\text{g/cm}^3$ , S=0.035%, CI=48.6, aromatics=26%) as a reference (B0), 2) 20% (B20%) and a 3) 30% (B30%) v/v blend of rape seed biodiesel-RME (according En 14214:  $\rho=0.88\text{g/cm}^3$ , CI=53) and regular diesel and biodiesel fuel ( B20%:  $\rho=0.84\text{g/cm}^3$ , CI=49.5), B30:  $\rho=0.86\text{g/cm}^3$ , CI= 51.5).

It is observed that density of biodiesel –B20 and B30 is higher, while the mass-based energy content is lower (8.5%) then those of mineral diesel. Also, it is observed that density of biodiesel - B30 exceeded ( $0.86\text{g/cm}^3$ ) the specification limit of EN 590 for mineral diesel.

Diesel engine emissions were measured in accordance with ECE R96 Regulation, 8-mode cycle.

### 3. RESULTS AND DISCUSSION

The value of specific emissions NO<sub>x</sub> and PM (g/kWh) for three types of diesel fuel are shown in Figure 4. They are the result of making an average value of an emission for each mode and basic parameters of engine functional characteristics.



*Figure 4: Specific PM and NO<sub>x</sub> emissions of diesel fuels-B0 and blend-B20 and B30 biodiesel fuels*

It can be seen from Figure 4, that PM emission level of B20 and B30 fuel is decreased by 11% and 21% respectively, in relation to the reference regular diesel fuel, whereas NO<sub>x</sub> emission level is increased by 15-18% respectively, in relation to the reference regular diesel fuel. It is unknown exact cause of the increased NO<sub>x</sub> emissions for biodiesel. However, a number of fuel properties - as cetane number, density, heating value and iodine number, as well as operating conditions have influence on NO<sub>x</sub> emissions [10]. The higher oxygen availability in the combustion chamber could promote higher NO<sub>x</sub> emissions. NO<sub>x</sub> emission level of B30 fuel is higher by 3% in relation to the blend B20. The fuel formulation, which results in oxygen being embedded in the fuel, could result in increased flame temperature in the premixed burning region. Also, it can increase heat release in the

premixed burning phase. It means that these factors lead to an increase in NO and NOx levels.

As far as PM emission, there are several factors that contribute in the reduction of its. The oxygen content of the biodiesel molecule, the absence of aromatics, the lack of sulfur, and the lower final boiling point of biodiesel are the main factors that govern PM formation. PM emission level of B30 fuel is lower about 12% in relation to the blend B20.

Fuel consumption was increased about 3, 5- 4.3% with respect to mineral diesel fuel due to the shortfall in energy content of B20 and B30. Also, it was observed 1, 5-2.5% loss of power output with the application of biodiesel-B20 and B30.

The engine thermal efficiencies were increased for B30 blend fuel. The addition amount of biodiesel to low-sulfur mineral diesel improved blend lubricity which would reduce frictional losses. On the other hand biodiesel contains as much as 10% oxygen, and the presence extra oxygen, particularly in the high loads, may help to improve the overall combustion process and improve thermal efficiency.

#### 4. CONCLUSIONS

The following conclusion may be drawn as a result of this study:

1. Studiously designed and launched the news, with the news media constantly repeated on the catastrophic dangers of climate change due to global warming, as a consequence of human activities in increasing concentrations of CO<sub>2</sub>, are unfounded and without scientific evidence.
2. Claims that the car is responsible for climate change due to CO<sub>2</sub> emissions are unfounded, and political demands to reduce automotive CO<sub>2</sub> emissions, there is justification only from aspect fuel consumption i.e. rational primary energy consumption, since CO<sub>2</sub> emissions is directly proportional to fuel consumption.
3. The density and cetane index of mineral diesel –biodiesel blends is increased compared to the density of the mineral diesel fuel, due to the higher density of the biodiesel fuel.
4. PM emission level of B20 and B30 fuel is decreased by 11% and 21%, respectively, in relation to the reference regular diesel fuel.
5. NOx emission level of B20 and B30 fuel is increased by 15-18%, respectively, in relation to the reference regular diesel fuel.
6. Using blends of biodiesel and mineral diesel can reduce consumption mineral diesel and therefore reduce the dependence on mineral oil imports, and reduction of energetic dependence.

7. Alternative fuels, particularly from lignocelluloses i.e. II generation biofuels are a great opportunity for the world economy and a great chance to increase employment, reduce the consumption of mineral fuels and reduce greenhouse gas emissions.

## **ACKNOWLEDGMENTS**

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