Ver. 001 – 11.04.2015

hydromoving

H_2O Energy

PRELIMINARY REPORT

Technical description of the Hydromoving System
Operating Principles
April 2015

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Oxyhydrogen generation on board Hydromoving System

CONTENTS

Abstract

Hydrogen has recently attracted attention as a possible solution to environmental and energy problems, even if hydrogen should be considered more a means of energy storage, rather than a naturalresource.
The free hydrogen does not exist in nature. Many techniques for obtaining hydrogen have been proposed. It can be obtained from 'reforming' of conventional hydrocarbons, or obtained directly from water by electrolysis or high temperature pyrolysis using a heat source such as a nuclear reactor.
However, the efficiency of these methods is low. The direct heating of the water up to temperatures high enough to sustain the pyrolysis process, is very difficult. The split pyrolytic water occurs when the temperature exceeds 4000 ° C (in the absence of catalysts).
On the other hand the method of hydrogen production by electrolysis there may be an alternative because, although easier to obtain compared to direct heating, in terms of energy is very onerous, as provided by Faraday's laws.
You can work around these problems of production efficiency and use these processes withoutneglectingtwoaspectsofapplication:
- Analyze the specific application where it used hydrogen. This analysis may provide, as in the case of the application hydrogen, important information about the inefficiencies of the system (possible energy sources for the hydrogen production) and possibility of involving hydrogen as the element 'active' in the application process. In the case of the Internal Combustion Engine application , they are known effects of increased efficiency due to the introduction of hydrogen in the combustion chamber, in the presence of conventional fuels.
- Use the latest information emerging from the world of physics of condensed matter, specifically the model of water 'Coherence Domains' emerged from the researches on the collective behavior of water molecules, to optimize the process of conventional electrolysis, using these properties.

In this preliminary report will show the first results obtained by theoretical / experimental data from this dual approach. They will describe the aspects and motor aspects electrolytic HydroMoving used to make the system more efficient than conventional electrolytic systems. They will describe the effects on fuel consumption obtained by the application on internal combustion engines (Otto cycle - 4 times) and will sign the effects on pollutant emissions.

ELECTROLYTIC HYDROGEN PRODUCTION - PROCESS EFFICIENCY

The amount of hydrogen and oxygen generated by electrolysis are provided by Faraday's law. The combustion reaction of the hydrogen gas is described by the following equation:

H_2 (g) + O_2 (g) → H_2O (g) + 242 kJ / mol (2.5 eV, when referring to single molecule)

This is the exothermic reaction of molecular hydrogen combustion in gaseous form. In ideal conditions such combustion give 242 kJ of energy per mole of H_2.

Analyzing the reverse reaction for the hydrogen production from water, always under standard conditions (STP=298 K and 1 bar pressure), it is calculated that to produce hydrogen (and oxygen) by electrolysis is necessary to provide the following amounts of energy, summarized in the following Reactions:

Evaporation

a) H_2O (l) + 44,1 kJ / mol → H_2O (g) (or H_2O (l) +0,46 eV → H_2O (g) - when referring to single molecule)

Electrolysis

b) H_2O (g) +242 kJ / mol → H_2 (g) +1/2 O_2 (g) (or H_2O (g) + 2.5 eV → H_2 (g) +1/2 O_2 (g).

Thus, the amount of energy to be administered to the process for obtaining hydrogen and oxygen from water in the stoichiometric mixture liquid is the sum of evaporation and the required energy cleavage.
In total it amounted to 286.1 kJ per mole of H_2O (about 3 eV for every molecule of H_2O).
The difference between the energy obtained from the combustion and the expenditure for the electrolytic cleavage is due to the fact that the combustion of hydrogen takes place between the gaseous species, while the process of molecular scission part by liquid water, to which is necessary to administer a additional amount of energy, called latent heat of evaporation, to turn it into gas.
This energy, in the case of combustion, is usable only in the case where a thermal machine is used as a condensing boiler. In a combustion engine it is not possible to exploit this energy transforming it into mechanical work.
The ratio between the amount of energy obtained from the combustion of hydrogen with the energy needed for the electrolysis under standard conditions and efficiencies ideal, you get a value less than

Energy ratio = 0.84

Considering the real efficiencies of the system components, the ratio value falls further. The application of this process to a heat engine Otto-cycle average of the size used in the automotive field, with the claim to use the same energy produced to the motor shaft to power the electrolysis, it is not convenient.

Whereas a conventional engine has a total efficiency η = 0.25, mean of 242 kJ / mol obtained by burning only 60.5 kJ / mol are transformed into mechanical energy available to the crankshaft.
This mechanical energy is used in part by the alternator of the car with a yield on average around 90%, to recharge the battery and to feed the passengers on board, including the possible electrolyzer.

Maintaining the return of alternator (0.9), and electrolyser (0.7), starting from 60.5 kJ / mol of mechanical energy only 38.115 kJ / mol (60,5x0,9x0,7) are supplied to the electrolyzer in the form of electricity.

This amount of energy corresponds to about 15% of the amount of energy needed to produce the hydrogen required at the beginning of the cycle, index of a process that will go quickly to run out.
This analysis estrememente partial and simplified serves to show the limits of the use of a cell elettrolica conventional for the production of hydrogen from water through the power of this motor shaft. Emerges clearly as the system in real conditions has no practical use.

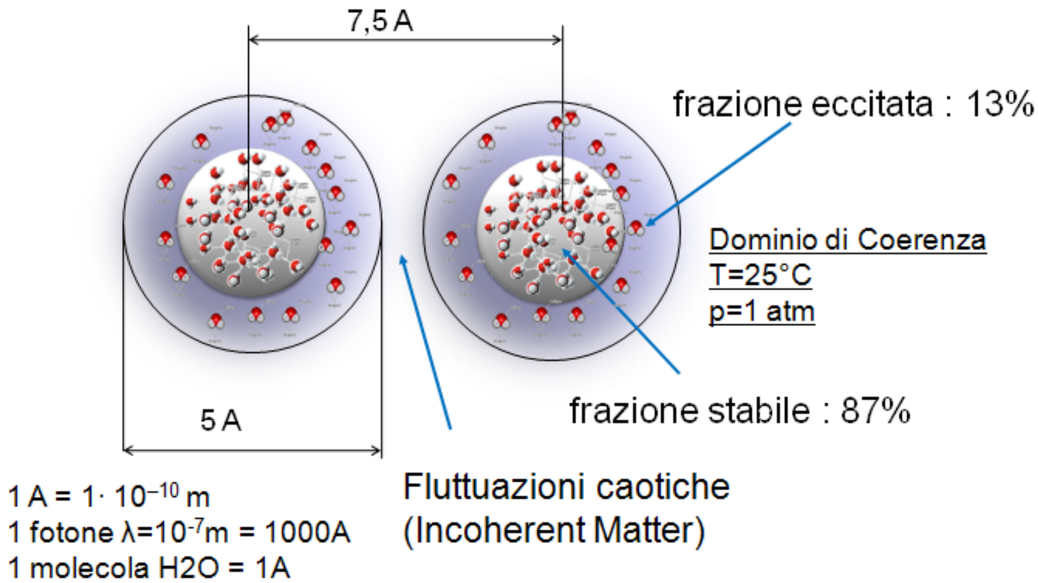
The water coherence domain

In the last thirty years we have been carried obtained important results regarding the structure of water through a collective approach suggested by the analysis of the behavior of molecules. These studies showed a model of water that can offer the possibility to split water more efficiently than traditional electrochemical approach.
On this basis we were developed control systems used in the electrolytic process systems HydroMoving.
The model is based on a water structure consisting of coherence domains.
According to this model, liquid water is not simply a chaotic collection of free molecules, moves by thermal and interacting through shock, dipole-dipole attractions, Wan Der Waals forces, hydrogen bonds, but a compound in which two states live together aggregation having the same molecular composition, but a part of which appears to be consistent (ordinate) and a busy part.
When water is found in its natural state of equilibrium, its electric dipoles (its molecules) are subjected to various oscillatory motions dictated by the interactions described above, but also by random fluctuations and related electromagnetic emissions (photons). When these electromagnetic oscillations come into phase with the oscillation of the field of matter of the water molecule, this reaches a condition of lesser energy and attracts around itself, through this interaction phase, other water molecules, up to occupy a volume of the order of the wavelength generated (λ3). In practice established between the water molecules attraction that follows the known interaction through the phase for which

a molecule oscillating with a frequency f is much more attracted to a molecule that oscillates at frequency f0 with a trend inversely proportional to the difference of f-f0.

These agglomerations molecular ESTABLISHED with this mechanism have a spherical symmetry and occupy a given spatial domain; hence the name 'coherence domain'.

The term 'coherence' refers to the fact that the formation of the domain is made possible precisely by the coherent oscillations of all the molecules that constitute the domain. The size of the domain depends on the interaction between wave size and thermal noise, causing vibratory motions chaotic random, can alter the stability of the coherence domain and limit its size.
Whereas, by orders of magnitude, the wavelength of a photon are able to trigger the phenomenon (10-7 m = 1,000 A)
and the size of a water molecule (10-10 m = 1 A)
you can calculate the number of molecules that can get into a coherence domain. The volume 'interstitial' present between the coherence domains is instead occupied by molecules not consistent and not in phase, moves from chaotic motions. These molecules can not get into a consistent coherence domain and join the oscillations existing or determine shock with it, disturbandone stability. For these reasons, the coherence domains can be considered structures "mesoscopic" intermediate between the molecular (microscopic) and the macroscopic. Water molecules present within a domain of coherence oscillate, in phase, between two different configurations of their electron cloud to the rhythm of an electromagnetic field of well-defined frequency and constant in time, which makes the structure stable as a energy level lower than that of free molecules and subjected to chaotic motion.
The coherence domains can be viewed as balls immersed in a sea of liquid water not consistent. On the border of the coherence domain, the interface with the unordered molecules, molecules are energetically 'excited', whose constituents have already almost all the energy necessary for ionization or dissociation



Scheme 1 - coherence domains of liquid water at standard conditions

For any given value of the temperature, and then for a given number of collisions with the molecules of the environment, a fraction of the water molecules is ejected to thermal shock or to random fluctuations and goes to feed a fraction not consistent that, as a dense gas, circulating in the interstices between the domains of consistency. The size of the coherence domains is linked to the thermal noise. As the temperature increases the size is reduced and vice versa.
The presence of these domains is favored by the proximity of the liquid at the surfaces of microporous material such as the plate of a conventional electrolytic cell, with its crystallographic imperfections nanostructured.

Particles "inconsistent" are identified as normal water molecules which are responsible for electrical conduction characteristics and solubilization.
As already mentioned, some of the molecules that form the border between the coherence domain and the water 'disordered' are in a condition next to the dissociation and the energy needed to scinderle into hydrogen and oxygen is less than that which would serve to decouple the molecules do not energized (eq. a) and (b).
Based on data listed above, considering the temperature of 25 ° C and the standard pressure of 1 bar, it is calculated that 13% of the water molecules constituting the coherence domain, arranged on the border of the same, it should be only 0.5 eV to be dissociated into hydrogen and oxygen.

In molar terms, the energy required appears to be about 48.4 kJ per mole of H_2O, equal to about 1/6 of that required for the dissociation of water in the non-excitation.

Once dissociated, these molecules interface are reset by other water molecules with the same characteristics in very short times, with a period [t0] the order of about seconds. All in ideal conditions.

This mechanism explains how it is possible to obtain an electrolysis at high efficiency, and as such, the efficiency can be achieved through a power supply of electrical impulses according to a wave that has as its period (t0) the reset time of the water molecules ready dissociation. In this way, the pulse will reach the plates in the moment in which all the molecules are almost free reset, having no other effect on the ordered ones and more stable.

Although conditions in 'real' and not ideal, the operation of the system HydroMoving for the production of hydrogen is based on this principle, using modulation modes and geometries of electrodes that depart from this model.

The considerations and calculations shown are based on an ideal process. Considering the real efficiencies and yields of the process, although not reaching the theoretical conditions, it shows that at present this mechanism can split water using less energy than required by a conventional approach.

EXPERIMENTAL DATA and CONSIDERATIONS ENGINE'S TUNING

engine – water - hydrogen

Since the beginning of the technique of internal combustion engines it is known that the injection of atomised water and hydrogen, duly mixed with the fossil fuel originating, increases the overall efficiency of the engine.
Various applications related to laboratory experiments and industrial applications show widely assumed that [ref.1,2,3]

The injection of water operates primarily on two factors: one cooling the inlet air motor, operating a decrease in temperature of the air entering obtaining the result of increasing the efficiency of the engine.

The other certainly more important is to cool the mixture in the combustion chamber by removing the danger of detonation, allowing combustion more efficient than the combsutione in the absence of water.

Generally the thermal efficiency also increases with the introduction of hydrogen into the engine mixed with the fossil fuel, and this is due to several factors:

a. a low-energy ignition that allows a 'rapid start;

b. a self-ignition temperature higher than the standard fuel only, this allows to increase the compression ratio, increasing the yield of the theoretical cycle, and real;

c. a flame speed of combustion very high. The burning rate of the hydrogen / air mixture is seven times higher than that of the air / petrol mixture. The burning rate of the fuel / hydrogen also extends beyond this value will depend on the relative percentages of the constituents. The transformation is approaching in this way the combustion cycle of isochoric ideal;

d. High diffusivity which implies greater mixing with the combustion air.

and. The ability to recombine with the hydrogen radicals present, improving the efficiency of combustion and heat release of the fuel itself.

THE HydroMoving system operates BOTH optimizations as it introduces in the engine:

- A mixture of hydrogen and oxygen already in stoichiometric proportion
- Droplets of water spray drag along with the gas produced

To exploit such effects in a practical and measurable, the entire engine control system and the system of electrolytic production of hydrogen must be calibrated, adjusted and tuned to be able to get all the benefits of the enrichment of hydrogen.

The thermal efficiency is related to the fuel consumption. The addition of hydrogen, as shown in various consolidated experiences, this increases the overall thermal efficiency and fuel consumption decreases (Figure 2 - ref.1).

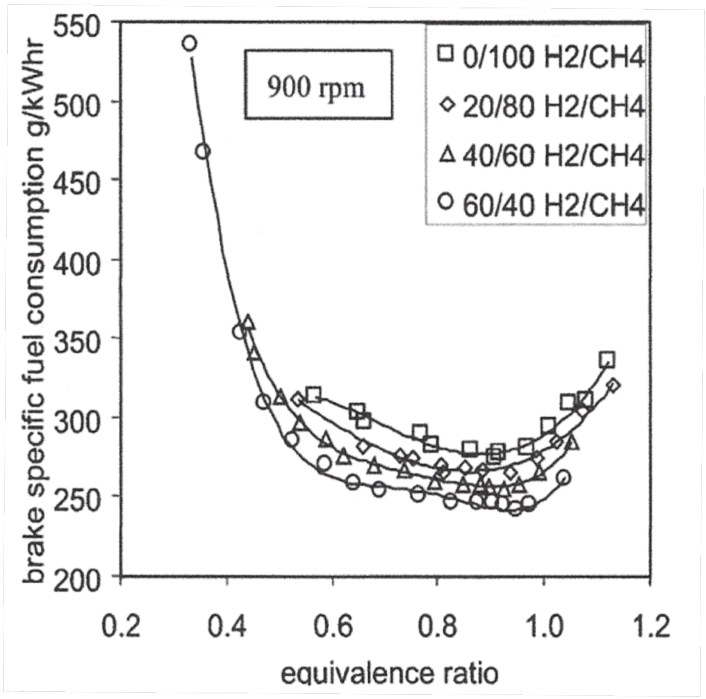


Figure 2. Reduction of fuel consumption to the increase of the addition of hydrogen

Figure 3. The variation of the thermal efficiency in relation to the mass of hydrogen.

Figure 3 - ref.1 - instead shows the effects of addition of hydrogen thermal efficiency of an engine with compression ignition. The injection of hydrogen is carried out in two different load conditions. The fuel mixed with hydrogen are: diesel fuel and vegetable oil (Jatropha oil).

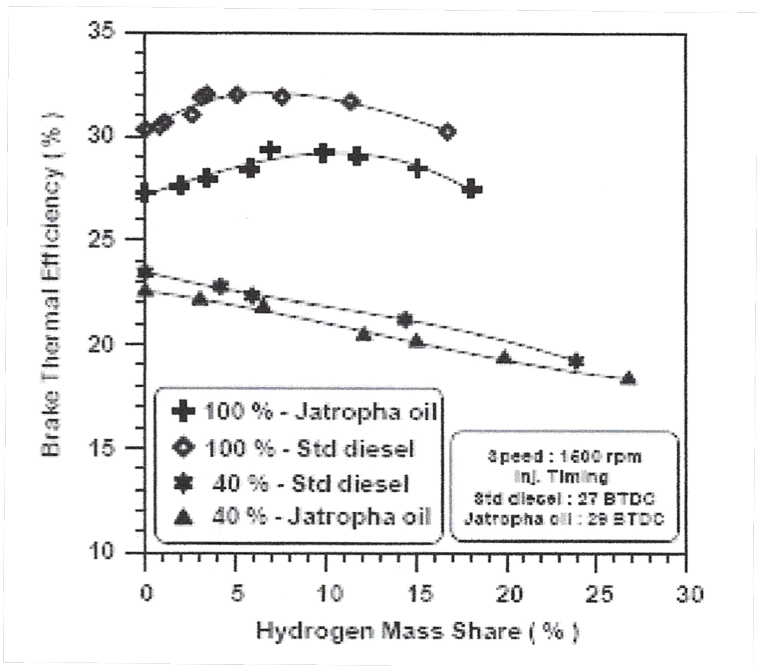


Figure 3. The variation of the thermal efficiency in relation to the mass of hydrogen.
The addition of hydrogen enables the engine to operate in conditions of very lean mixture (Ultralean combustion).
A small amount of hydrogen mixed with gasoline and air produces a recombination of the chemical species involved in the composition of the mixture that can be burned, changing the chemistry of the fuel. Such a mixture allows a common internal combustion engine, to be able to work in conditions of equivalence ratio below the lower flammability limit of the single lean mixture of gasoline and air.
The result is a release of heat of combustion gradual and uniform which increases the efficiency of the engine.
They are reduced emissions of carbon monoxide (CO) and hydrocarbons (HC) thanks not only to the possibility of operating with lean mixture, but also to the speed of propagation of the flame produced by the combustion of hydrogen, which allows a complete reaction of the fuel in the compression stroke (Figures 4 and 5 - ref.1).

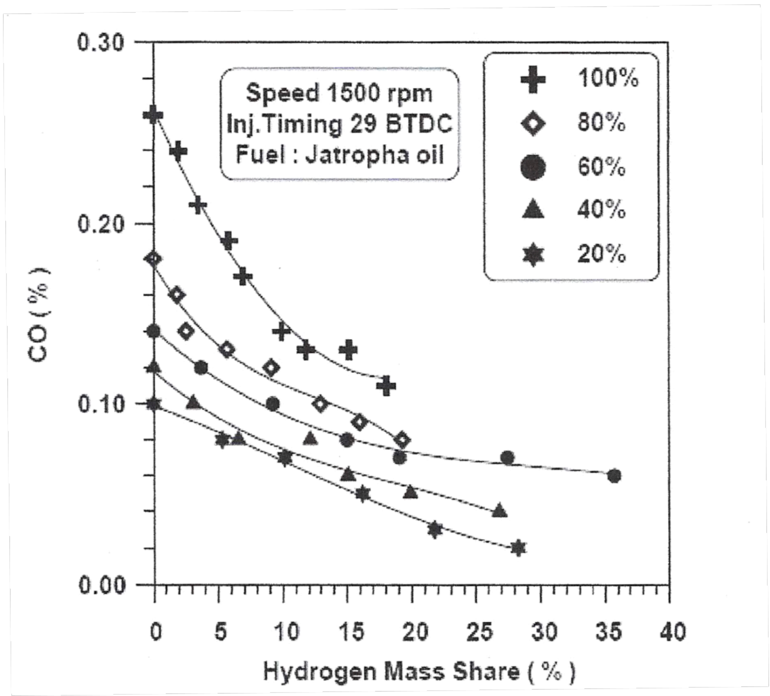


Figura 4. Effect H2 addition on emission CO combustion of vegetable oil

Figura 5. Effect of the addition of hydrogen on the emission of THC (Total Hydrocarbons Unburned) of the combustion of natural gas

Even NOX emissions can be decreased in case you adopt changes that delay the time of ignition in the combustion chamber in the presence of lean mixtures. Figures 6 and 7 (ref.1) show the effects of the addition of 70 g / h of hydrogen on emissions of an engine at a constant speed of 3000 revolutions / min. In particular, Figure 7 shows how the NOX products diminish more and more with increasing air / fuel ratio.

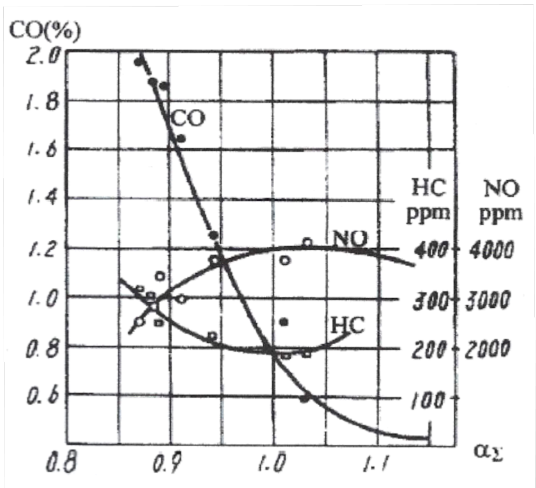


Figure 6 Emission value on ICE gasoline fueled

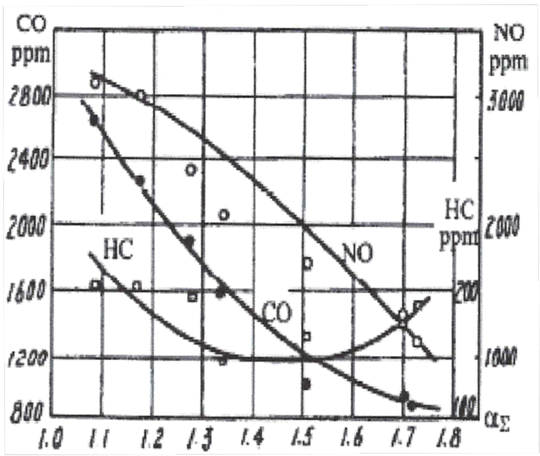


Figure 7 Emissions value after Hydrogen addition.

Experimental and Test results

5.2. ***Effects on emissions and fuel consumption*** *Thorough testing on a chassis dynamometer, where they performed modal analysis on emissions related to the cycle of approval of legislation Euro4 / Euro5 (see Figure 8), allowed the carrying differentiated analysis in which emissions and fuel consumption of the same vehicle were is monitored in the original configuration in the presence of system HydroMoving active. The vehicle used is a car Nissan 370 Z.*

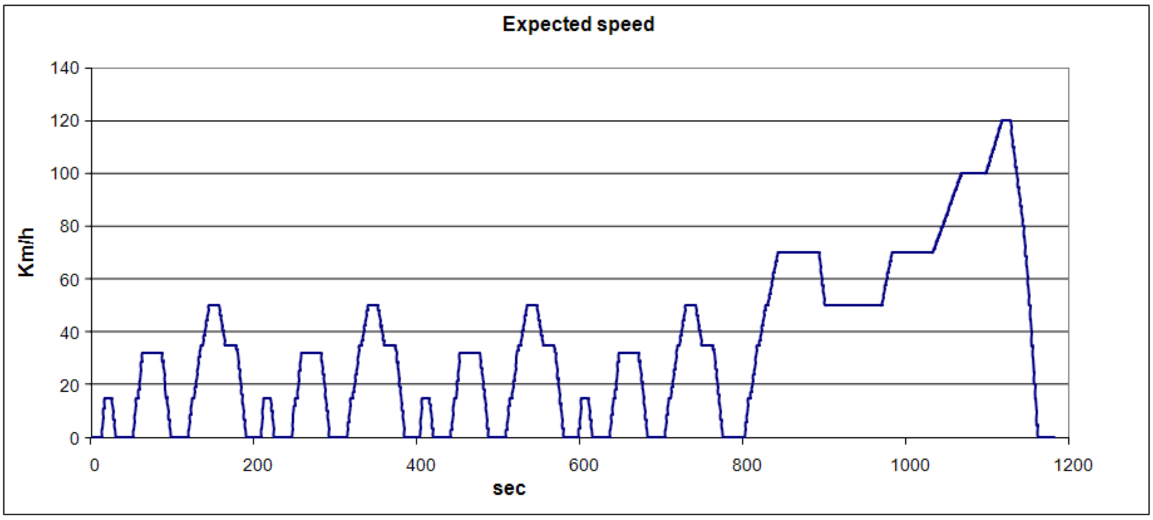
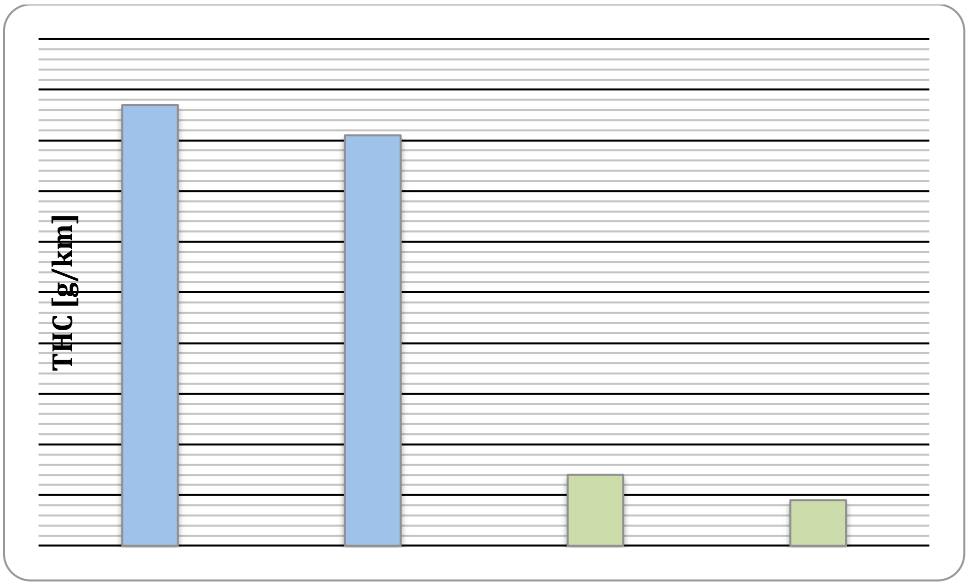
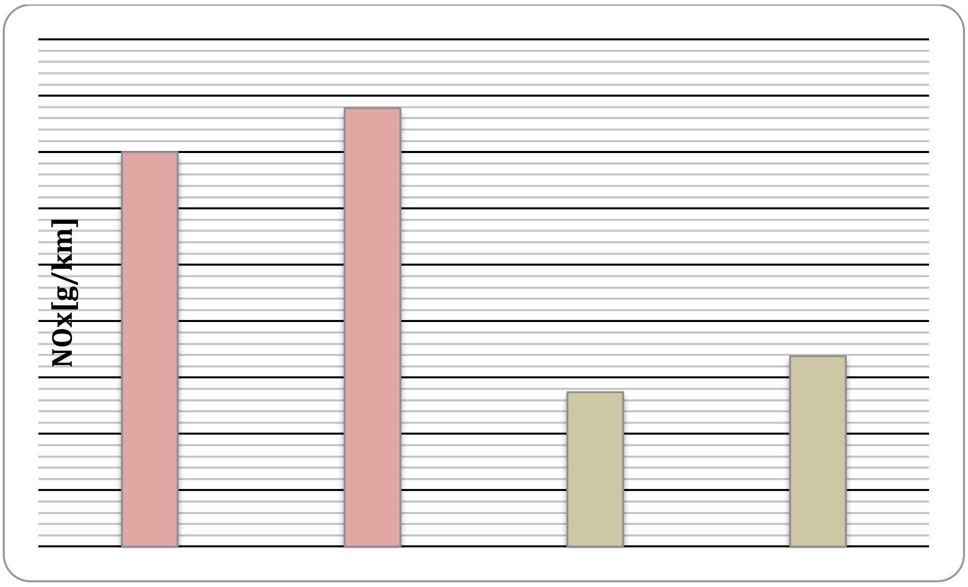


Figure 8. European Cycle approval vehicles NEUDC

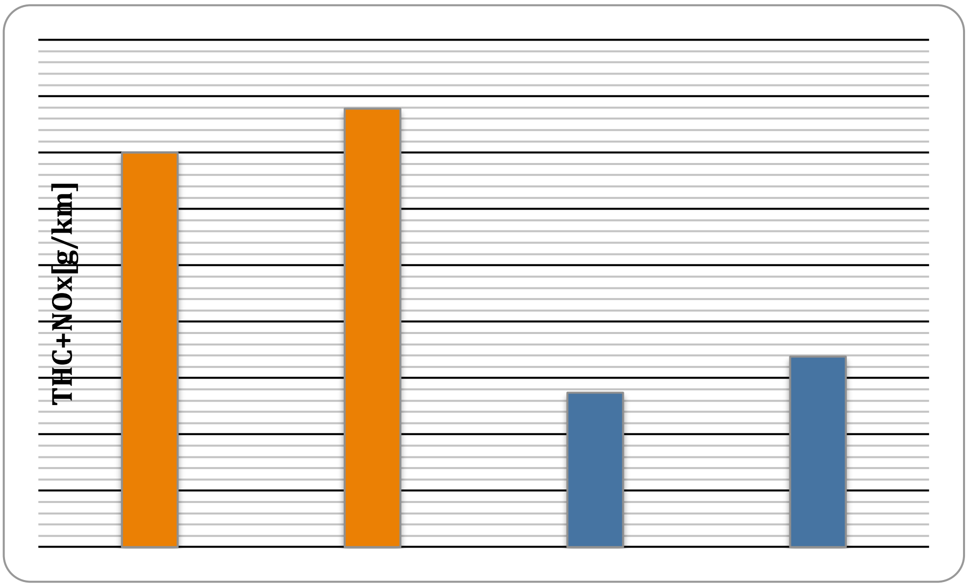
The results of the comparison between the emissions measured with the system turned off, and those relating to measures carried out with the active system are shown in the following diagrams :



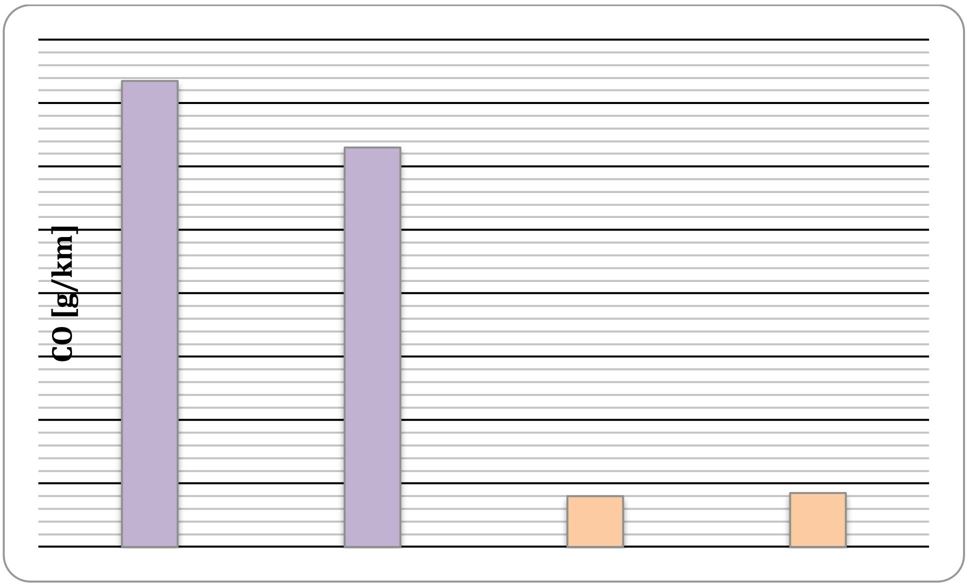
Comparing the emissions of HC measured system HydroMoving off (blank) and system HydroMoving active (test)



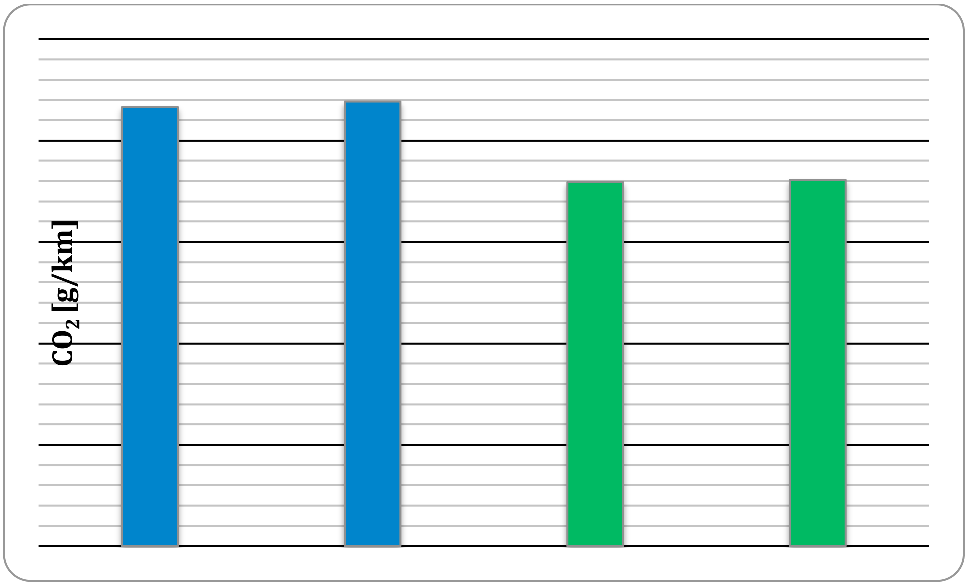
Comparison of the NOx emissions measured with system HydroMoving off (blank) and system HydroMoving active (test)



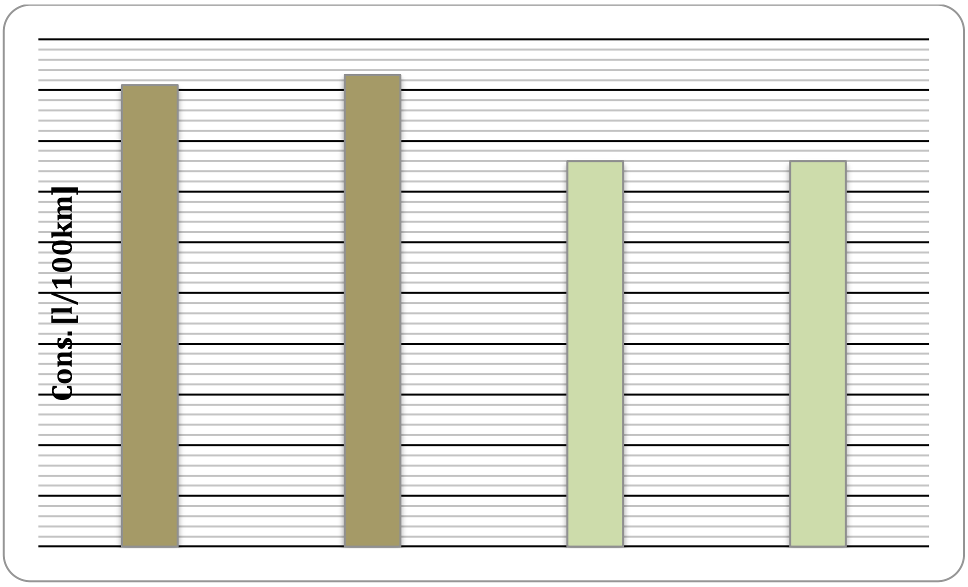
Comparison of THC + NOx emissions measured with system HydroMoving off (blank) and system HydroMoving active (test)



Comparison of CO emissions measured with system HydroMoving off (blank) and system HydroMoving active (test)

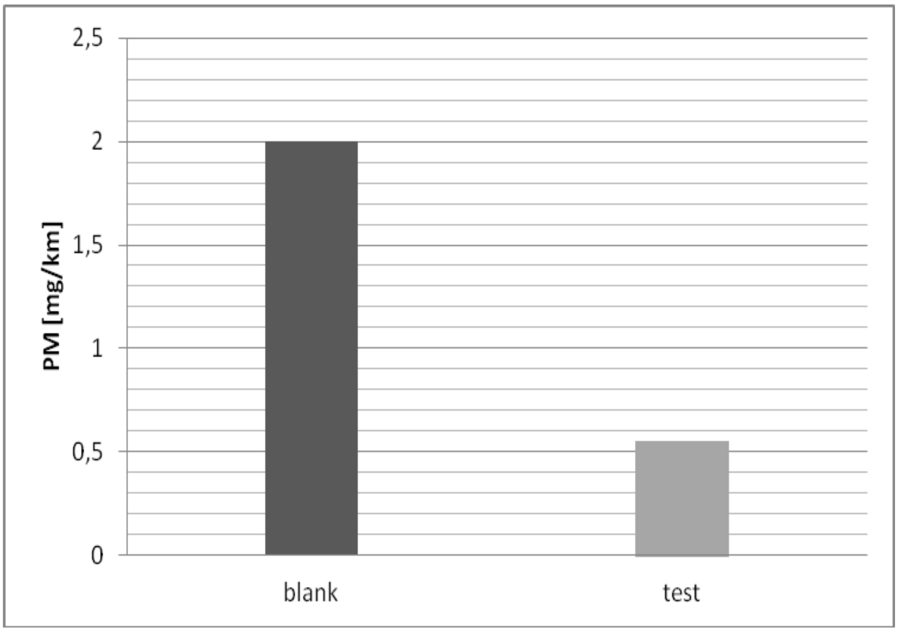


Comparison of CO2 emissions measured with system HydroMoving off (blank) and system HydroMoving active (test)



Comparison of the average consumption of gasoline measured system HydroMoving off (blank) and system HydroMoving active (test)

Results on the measurement of particulate matter for diesel engines (BMW) relative to the same test:



Comparing the emissions of particulate matter (PM) measured with System HydroMoving off (blank) and System HydroMoving active (test)