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Variations of CO_2 Concentration Rates in the Abatement of Air Pollutants from Mobile Sources Using a MEB Minimizer

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Abstract - Authorized sources, have stated, emphatically, that the most effective way to reduce CO_2 emissions is fossil-fuel consumption reduction. We have been confirming it from 2008, as a consequence of abating pollution controlling CO_2 emissions by magnetic action. In this paper, a balanced combustion using a MEB minimizer, is highlighted, from results. Sciences have revealed the stability of atmosphere gases proportions, for million years, with about 0.036% CO_2 whose levels underwent slow fluctuations below 300 ppm for more than 400,000 years. However, since 1750, fossil-fuels burning have increased its concentration in the atmosphere about 50%. Fossil-fuel derived CO_2 is a tiny component of the global carbon cycle, but it is cumulative because the natural carbon exchange cannot absorb all additional CO_2. Therefore, the level of atmospheric CO_2 is building up, and in approximately 120 years, after pre-industrial era, has increased in 100ppm. This results in an average concentration increase rate of $\frac{\mathbf{0.83ppm}}{\mathbf{year}}$. A natural increase of 100ppm occurs in a period from 5000 to 20000 years, giving rise to maximum or minimum values of $\frac{\mathbf{0.02ppm}}{\mathbf{year}}$ or $\frac{\mathbf{0.005ppm}}{\mathbf{year}}$, respectively. Consequently, the change rate of fossil-fuel derived CO2 is from 42 to 167 times greater than the natural one. Natural processes allow to restore the systems because they can change and after a relaxation time, equilibrate the new driving forces. When these are increasingly fast, the Earth systems cannot relax to equilibrate them, until sudden changes occur. Signs of those changes are frequent nowadays. Therefore, we cannot dismiss CO_2 concentrations rate. It is a critical variable to control. Consequently, in this paper, Cyclical CO_2 variations through the last 400000 years and Carbon cycle are detailly analyzed, and concentration rates reductions and its final steadiness, from results in two cars are shown, proving the MEB efficiency to control variations of CO_2 concentrations rate.

***Keywords*:** Relaxation, COBMA (Combustion by Magnetic-Action), MEB (Magnetic Efficient Balanced), Unstable, Geomorphic, Change-Rate, Fluctuation.

1. Introduction

Nature points out to keep the proportion of its elements and laws regulating changes. [1]. We cannot give up continuing to emphasize that the **global comprehension** of the Air Pollution-Climate Change issue is determinant and crucial for its urgent solution. It is huge the work done by scientists, intergovernmental bodies, governmental programs and institutions having the responsibility of measuring, studying, assessing to political leaders for decision making , supporting international agreements and illustrating to common people in general, about climate [2] [3] [4] [5]. However, it has not been enough to mitigate the climate crisis because, global integration around a unifying paradigmatic idea for comprehension of the climate crisis essence has not been possible and, consequently, inescapable synergistic work to effectively tackle it, is insufficient. Multiplicity of different plans and projects beyond the possibilities of many countries has created a global babel of opinions and misconceptions, at different intellectual levels, hindering efficient global actions and undermining the achievement of the main global goals. Consciously or not, a global imprecise and ambiguous language is used, hiding, in the background, the human responsibility of the climate crisis and the obligation of reducing urgently the emissions to the atmosphere, mitigating the crisis that we, ourselves, have caused and preserving our human species. The earth is fighting back, if we disappear, the planet will recover as it can be watched in the video "The Earth without Humans ". The idea of changing the way of living, seeing the earth as if it were alive at least to the extent of regulating its climate and chemistry, would favor inescapable synergistic work. A strong interaction Science-Engineering is needed to solve the climate crisis. In theory, is recognized that human activities have triggered emissions in excess to the atmosphere, warming the planet in the

last 120 years, but we do not act in consequence. Nature is showing through increasing extreme weather events and disasters what the final could be if emissions to the atmosphere are not, at least mitigated urgently.

The real essence of the climate crisis is our rejection to accept that we must see it under a more comprehensive view. Therefore, we appear determined to continue breaking the balance of the Earth-Atmosphere system. This is why in this paper we emphasize that the increasingly CO_2 concentration rate is determinant in the deterioration of Physical Systems; showing clears signs of Air Pollution -Anthropogenic Climate Change deadly impacts, explaining basically its theoretical fundamentals and finally through results and conclusions to present a solution that perhaps is the most globally simple and opportune to mitigating emissions to the atmosphere from mobile sources: It is COBMA; An Integrative, proven, effective, scalable and affordable action.

1.1 Physical Systems

In physics, a physical system is any object or part of an object that can be analyzed with the laws of physics. An atom, a Hookean spring, a river flowing, the clouds or the water in a lake can all be considered as physical systems. Everything outside the system is called the environment, which in the analysis is ignored except for its effects on the system.

1.2 Deadly Impacts of the Air Pollution-Anthropogenic Climate

Billions of people still breathe unhealthy air. April 4/2022 [6]
Sea-level rise is double the rate it was 30 years ago. [7]
Oceans are hotter than ever and getting warmer faster. [7]
Parts of the Amazon Rainforest now emit more carbon than they absorb. [7]
Frequency of rains also has increased or decreased.
In some regions reduction and disappearance of snow-covered areas
There is registered tendency to increase, annually, the mean sea level in three to four millimeters in Pacific and in one to two millimeters in the Caribbean.

Over the last decade, nearly 4 billion people suffered climate-related disasters. [8]

The Artic Meltdown: The Arctic Ocean is melting, and it is melting fast. This past summer, the area covered by sea ice shrank by more than one million square miles, reducing the Arctic icecap to only half the size it was 50 years ago. [9]

1.3 Relaxation Time

In the physical sciences, **relaxation** usually means the return of a perturbed system into equilibrium. Each relaxation process can be characterized by a **relaxation time** τ. The simplest theoretical description of relaxation as function of time t is an exponential law $e^{-\frac{t}{\tau}}$ (exponential decay). The relaxation time τ is the time constant of the exponential return of the system to equilibrium after it has been perturbed. **The relaxation behaviour of a system is characterized by the length of time for reaching equilibrium, within that time span, minor or major changes are induced in the physical property or properties that define the system.** Simple linear cases, where the main property changes are ruled by analogous equations from exponential decay, differing only by a constant factor are applied to RC and LR circuits, damped SHO, chemical reactions and many others in different fields of sciences are examples. There are more complicated nonlinear cases to which apply the same general considerations, but the equations are complicated. Relaxation is a very important process in natural and in human induced changes, through which action-reaction law is applied.

The study of those cases allows to think that the system has changed from an initial state to a final state of equilibrium, through a change of the characteristics that define it. When the changes are abrupt, characteristics change abruptly, and the system may collapse. In a RC circuit, for example, after a time, equal to RC, the current in the R-C circuit decreases to about 0.368 of its initial value. Currently, the capacitor charge has reached about 0.632 of its final value Q_f. In this case the exponential decay $e^{-\frac{t}{\tau}} = \mathbf{e}^{-\frac{\mathbf{t}}{\mathbf{RC}}}$. The product RC is therefore a measure of how quickly the capacitor charges. RC is called

time constant, or the relaxation time, of the circuit. [10] Analogous considerations can be made for a LR circuit [10]. If RC time is short, then R is low, and a short circuit will occur. This, and many other analogous conditions of a fast-increasing action on a system, that may cause its collapse can be considered to understand what happens to other, non-linear, more complex physical systems.

Results from 2 experiments of Physics 3 lab carried out by students to find the elastic constant of a Hookean spring by static and dynamic procedures respectively, taking 8 weights of 0.5kg each, to create forces, incrementing applied forces successively by 0.5kg , getting forces ranging from 0.5Kg to 8Kg, were obtained in the static procedure, applying Hook law $F = -kx$ to find the correspondents 8 deformations and in the dynamic procedure were calculated applying the expression $T = 2\pi\sqrt{\frac{M}{k}}$ where M is the mass of every weight and making the spring to oscillate for every group of weights from 0.5Kg to 8Kg to calculate period T and then finding the 8 values of k. The constant correspondent 8 values of k in the dynamic procedure, using the same 8 forces, were all lower than in the static procedure. In the static procedure k values ranged from 20.4 $\frac{N}{m}$ to 25 $\frac{N}{m}$ and in the dynamic procedure from 16.5 $\frac{N}{m}$ to 24.5 $\frac{N}{m}$. These lower values of k in the dynamic procedures when the weights increase continuously, can be interpreted as a loss of elastic energy of the spring (internal potential energy) that at the same time implies a loss of the spring capacity to counteract the external action If the weights continue increasing, the spring will be broken, and all the system will collapse. The previous information could help to understand the following information about the importance of the relaxation time in a complex physical system, where simple laws of basic physics cannot apply and information about the systems is obtained by means of Physics-Mathematic models and careful measurements with high precision instruments.

1.4 Fast Increasing Driving Forces and The Earth Physical Systems [11]

Climate-Change represents a disturbance to the driving variables. Physical systems respond to a disturbance by altering their morphology to accommodate the new driving forces. But this response does not happen instantaneously. There is a time span of instability until the Earth physical Systems, after a relaxation time are, again, in equilibrium with the new driving forces. How a system responds to change depends on the presence of positive or negative feedback processes. A negative feedback process is one that tends to restore the system to its previous state when it is disturbed, while a positive feedback process tends to accelerate the disturbance. Hence, systems with negative feedback tend to be stable, while positive feedback systems are unstable. Natural processes allow to restore the systems because they can change (reaction) relax and then equilibrate the new driving forces. **When driving forces are fast increasing continuously, the Earth systems cannot react to equilibrate the driving forces, until sudden changes may equilibrate the driving forces. Today we are experiencing those changes. Those sudden changes can result in breaking, abruptly, the earth balance putting at risk human life. Today, there are signs of those changes in some regions; disappearance of the snow-capped mountains, increase in the average sea level, increase ad decrease of the frequency of rains; Artic Meltdown and the degradation of ecosystems. How an increasing driving force can break a system balance could be better understood through analogies with other simple linear physical systems because of generality and complexity of the Earth´s Systems. However, this is out of the purpose of acquiring Global Comprehension of Climate Change issue because is not within the reach of every person. It is understood by people who are working within the scientific or technological field.**

2. Stability of the Atmosphere Elements Composition: A Manifestation of Balance Which is a Determinant Key for Mitigation

Paleoclimatology study has revealed the stability for 200 million years, Atmosphere elements whose composition have been much the same as they are today, with about 0.036% of CO_2. Its levels remained below 300 ppm for more than 400,000 years. But in the last century, the burning of fossil fuels has rapidly driven atmospheric CO_2 levels to new heights, overriding the natural cycle. Carbon dioxide concentrations have increased substantially since the beginning of the industrial era, rising from an annual average of 280 ppm in the late 1700s to 423.28 ppm in April 2023. Approximately a 50 % increase. Almost all of this increase is due to human activities.

April 2023 CO_2 level 423.28 ppm was over the April 2022 level of 420.23 ppm. Having an increase of 3.06 ppm/year, with a high probability to get higher. Showing, with respect to March and months before. This is an increasingly variation rate that must be controlled as soon as possible reducing emissions to the atmosphere.

2.1 Global Natural Carbon Cycle. [12].

Figure 1 shows the Global Natural Cycle. Though Anthropogenic CO_2 concentrations contributes with a tiny part of 6GT to the total 720GT, cannot be totally absorbed and are building up at an accelerated increase rate in the atmosphere. They have increased 100ppm in the last 120 years. That accelerated variation rate of anthropogenic CO_2 concentrations in the atmosphere identifies it as a critical variable to control urgently.

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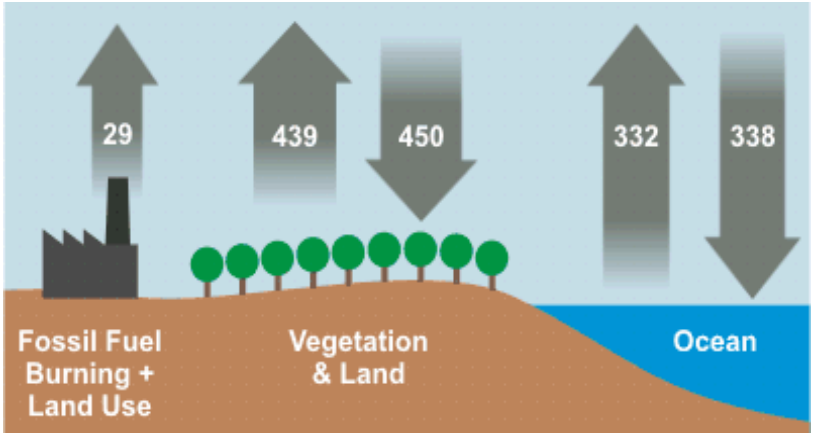

Figure 1. Global Natural Carbon Cycle.

2.2 Stable Rank of CO_2 Concentration Variations Over Past 400.000 Years [13]

Figure 2 shows Cyclical CO_2 variations through the last 400000 years and Geomorphic Equilibrium of the Earth- Atmosphere System. Human influence is clearly revealed by the increasingly accelerated rate of emissions concentrations in the last 120 years, altering the pattern of natural stable Rank of CO_2 concentration variations over past 400.000 years. To the extent that the slope of concentration rates has been highly steepened. So much, that looks next to reach an inflexion point with the implied catastrophic consequences.

2.3 Variation Rate of CO_2 Concentrations. A critical variable to control

2.3.1 Human Made CO_2 Concentration Rate Vs Natural CO_2 Concentration Rate

The additional CO_2 concentration of human emissions is a tiny percentage of total CO_2 emissions. However, it cannot be stated that it has nothing to do with global Climate Change because CO_2 concentration, in the atmosphere, in approximately 120 years after pre-industrial era, have increased in 100ppm. This results in a concentration increase rate of $\frac{0.83ppm}{year}$. A natural increase of 100ppm occurs in a period from 5000 to 20000 years. Given rise to a maximum increase rate of $\frac{100ppm}{5000year} = \frac{0.02ppm}{year}$, or minimum increase rate of $\frac{100ppm}{20000year} = \frac{100ppm}{20000year} = \frac{0.005ppm}{year}$. An increase rate comprised between $\frac{0.02ppm}{year}$ and $\frac{0.005ppm}{year}$. $\frac{0.83}{0.02}$= 41.5; $\frac{0.83}{0.005}$= 166. Human CO_2 Variation rate is between 42 and 166 times higher than natural CO_2 variation rate.

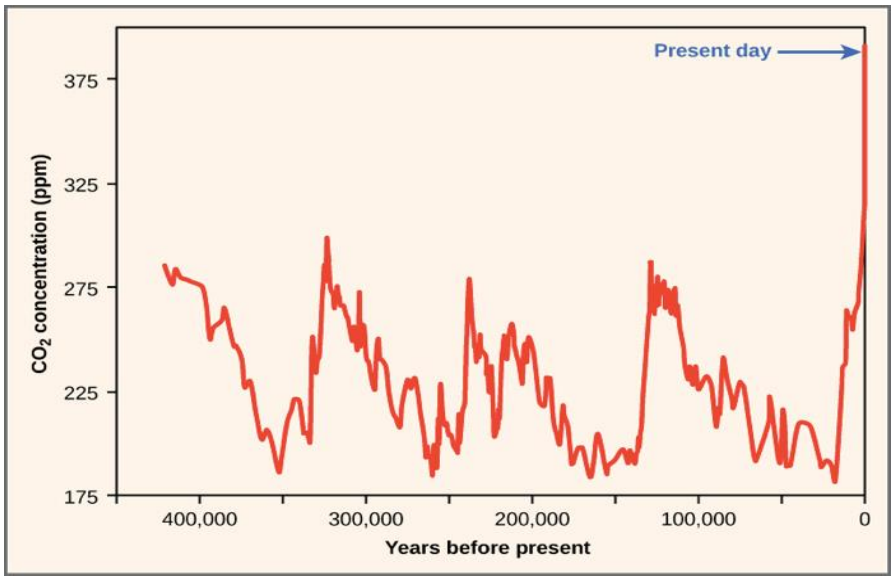

Figure 2. CO_2 Levels Naturally Rise and Fall Cyclically Over the Past 400,000 Years
Image credit: "Threats to biodiversity: Figure 1" by OpenStax College, Biology, CC BY 4.0

Figure 3.1a. Built at Home in 2022 for Emissions tests

Figure 3.1b. Built in Mekanos 2019 Used to Obtain Data

3. Obtained Data and Test Results

In figures 3.1a and 3.1b magnetic devices without retreatment, for testing and obtaining consumption data are shown. Figure 3.1a and Figure 31.b are two versions of the magnetic device without hydraulic pre-treatment designed and built in 2017 by Professor Raul Guerrero Torres for Lab experiments. Emission tests results were obtained with the device of Figure 3.1a installed in a Chevrolet Sail Car from October 26, 2022, to March 14, 2023. Consumption data were obtained with the device of Figure 3.1b installed in a Renault Stepway car from April 13 to December 13 of 2019.

3.3 Tests Results 2022-2023

Table 2 Chevrolet Sail Car BPW 341 Periodic Tests Results 2022-2023.

HC (ppm)	168	159	10	8	40,4	22	1,6	42
CO2(%)	13	13,1	12,2	14,2	11,6	11,4	11,5	12,3
CO(%)	0,89	0,8	0,01	0,01	0,06	0,03	0,04	0,24
O2(%)	1,13	1,1	3,42	1,16	3,4	3,72	3,45	3,38
Days	0	1	99	125	132	139	146	153

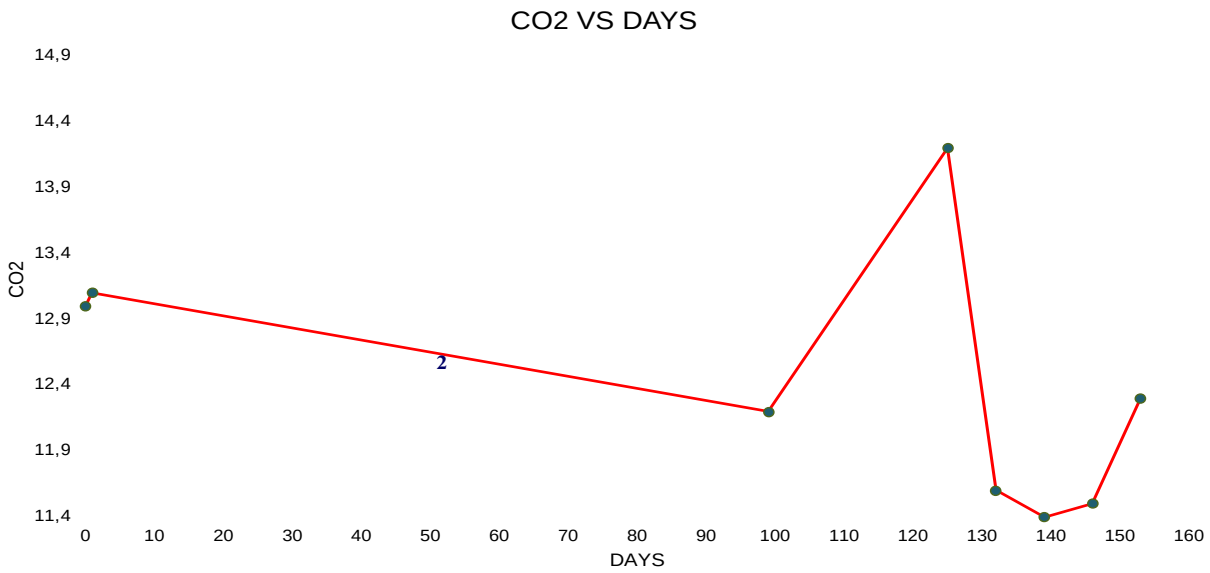

Figure 4. Graph of CO_2 variations in percentages versus time in days.

Figure 4 shows 6 phases in the process to controlling CO_2 emissions with a magnetic minimizer without Hydraulic pre-treatment.

1. An initial CO_2 variation whose amount depends on HC and CO reductions.
2. In general, an observable CO_2 reduction.
3. An increase that depends on eventual changes of the fuel, Air/fuel mixture relation, variation of magnetic induction for installation errors, car driving conditions or others that must be controlled.
4. A reduction, with trend to steadiness follows the increase.
5. In general, reductions at either side of an intermediate value showing a clear trend to get steady.
6. In general, a final increase to a value lower than the initial increase is reached.

In the next bars diagram (Figure 6) variations are shown in detail.

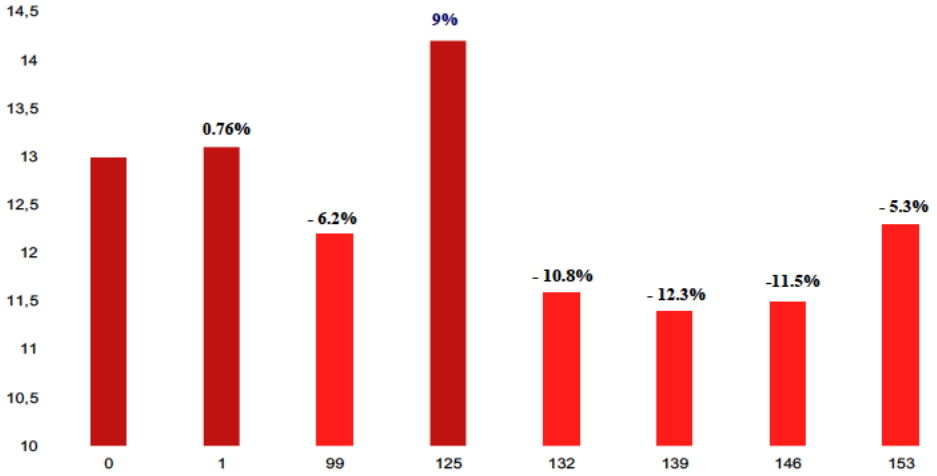

Figure 5. CO_2 percentages variations versus time in days.

In Figure 5, Bars diagram from the Chevrolet Sail Car BPW 341 Periodic Tests Results in Table 2, percentage variations with respect to the initial value without the magnetic device are shown. There are not consumption data to evaluate, with an acceptable degree of accuracy, the amount of CO_2 emissions reduction of emissions to the atmosphere. However, the last four percentages of CO_2 emissions reductions lead to a reduction of the increase rate of CO_2 emissions concentrations in the atmosphere, as it will be shown ahead for the Renault Stepway car. An initial very low CO_2 increase less than 0.8%, a considerable increase of 9%, an important reduction of 6.2%, reductions over 10 % tending to get steady, and a final reduction of - 5.3% are shown. The CO_2 emissions variations percentages changed from 9% to -5,3 %. A net reduction of 14,3% in 28 days.

Table 3. Consumption record of Renault Stepway Car in 2019.

GASOLINE CONSUMPTION RECORD FROM APRIL 13 TO DECEMBER 13 YEAR 2019 FOR RENAULT DLL 112 CAR							
Kilometres	**Gal**	**Date**	**Mileage**	**Consumption Reductions (Gal/km)**	**CO2 Emissions Reductions (KG/KM)**	**Total CO2 Reduction (KG)**	**GASOLINE TANK DAYS**
24,357	9,5	Abril 13/19	210	0,039	0,347	72,85	1,00
24,567	8,1	Mayo 4/19	222	0,048	0,427	94,78	21,00
24,789	8,97	Mayo 30/19	232	0,045	0,400	92,86	26,00
25,021	9	Junio 13/19	254	0,049	0,436	110,70	14,00
25,275	5,18	Julio 5/19	137	0,046	0,409	56,05	22,00
25,412	5,103	Julio 16/19	120	0,041	0,365	43,76	11,00
25,532	6,23	Julio 27/19	106	0,025	0,222	23,57	11,00
25,638	7,04	Agosto 10/19	166	0,042	0,374	62,01	14,00
25,804	6,53	Agosto 29/19	194	0,05	0,445	86,28	19,00
25,998	9,13	Septiembre 4/19	214	0,041	0,365	78,04	6,00
26,212	8,4	Septiembre 13/19	177	0,037	0,329	58,25	9,00
26,389	9,19	Octubre 8/19	232	0,044	0,391	90,80	25,00
26,621	8,82	Octubre 25/19	221	0,044	0,391	86,49	17,00
26,842	9,185	Noviembre 20/19	191	0,036	0,320	61,16	26,00
27,033	8,265	Diciembre 13/19			Total CO2 Reduction	**1017,62**	23,00
	Average Consumption			**0,042**	**0,373**		**245,0**

From the consumption record table, the following reductions were found:
Average Gasoline Consumption Before installing the Magnetic Device = 0.084 Gal/Km,
Average Consumption reduction with the device installed = (0.084-0.042) Gal/Km=0.042 Gal/Km,
Average CO_2 Emission reduction = 0.373 Kg/Km,
Probable Total CO_2 Emissions Reduction 1017, 62Kg,
Probable Total CO_2 Emissions Reduction Per Day = 4.15 Kg/day, and
Total CO_2 Emissions Reduction Per Year = 1514.75 Kg/year.

4. Calculations

The following equations are used for the calculation purposes:

$$P = 10^2 \frac{T}{M} \quad (1)$$

$$R = 10^4 P \quad (2)$$

$$R = 10^6 \frac{T}{M} \quad (3)$$

$$R_T = NR \quad (4)$$

Where:

P= Percentage of CO_2 concentration reduction in the typical car relative to the mass of the earth´s atmosphere

T= Total CO_2 concentration reduction according to consumption table results in a Typical car (Chevrolet Sail)

R= CO_2 concentration reduction in $\frac{ppm}{year}$ for the typical car

N= Total number of light cars on road in 2022

R_T= Total CO_2 concentration reduction in $\frac{ppm}{year}$ for all cars on road worldwide in 2022.

The purpose of the following calculations is to show the huge CO_2 reduction amount that could be obtained using the magnetic device in most of the light cars in the world. Although they are not precise, but it shows the reduction power of the minimizer.

Atmosphere mass = M= 5.1 x 10^{18} kg [14]

CO_2 reduction (from table results) = T= 1514,75 Kg according (table) 2.

CO_2 concentration reduction in $\frac{ppm}{year}$ for the typical car= R= $10^6 \times \frac{1514{,}75\ \text{Kg}/year}{5.1 \times 10^{18}\ \text{Kg}} = \frac{297ppm}{year} 10^{-12}$

Total light cars on road worldwide in 2022=1.46×10^9

Total CO_2 concentration reduction in $\frac{ppm}{year}$ for all light cars on road worldwide in 2022=$1.46 \times 10^9 \times \frac{297ppm}{year} 10^{-12} = \frac{0.43ppm}{year}$.

This means, approximately, a reduction of 48% in the present CO_2 concentration increase rate. Theoretically, a huge Power of the magnetic device without pre-treatment to reduce air pollution controlling CO_2 emissions. It is effective to tackle Air Pollution and Anthropogenic Climate Change at the same time.

5.Conclusions

The following conclusions are drawn from this study:

1. Results from Table 1 confirm that the best way to reduce, emphatically, that the most effective way to reduce C O_2 emissions is fossil fuel consumption reduction.
2. Reduction of CO_2 per year suggest a reduction in the increase rate of CO_2 in the atmosphere.
3. From analyses of test results, it can be concluded that a magnetic minimizer without pre-treatment not only reduce HC an CO_2 effectively but control CO_2 emissions making them steady after several weeks, reducing the increase rate of CO_2 emissions and consequently the increase rate of CO_2 concentrations in the atmosphere.
4. The reduction power of the magnetic device is huge. It is effective to tackle Air Pollution and Anthropogenic Climate Change at the same time.
5. More tests must be done, and more consumption data collected to improve the performance of the magnetic device without hydraulic pre-treatment.

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