Print ISSN: 0975-5861
Online ISSN:2249-4596

Global Journal

of Researches In Engineering: B
Automotive Engineering

DISCOVERING THOUGHTS AND INVENTING FUTURE

Pinnacles

August 2011

Volume 11

Issue 5

version 1.0

ENG

Global Journal of Researches in Engineering: B

Global Journal of Researches in Engineering

Automotive Engineering

Volume 11 Issue 5 (Ver. 1.0)

Open Association of Research Society

Incorporation No.: 0423089
License No.: 42125/022010/1186
Registration No.: 430374
Import-Export Code: 1109007027
Employer Identification Number (EIN):
USA Tax ID: 98-0673427

Global Journals Inc.

*(A Delaware USA Incorporation with "Good Standing"; **Reg. Number: 0423089**)*

Sponsors: *Open Association of Research Society*
Open Scientific Standards

Publisher's Headquarters office

Global Journals Inc., Headquarters Corporate Office, Cambridge Office Center, II Canal Park, Floor No. 5th, ***Cambridge (Massachusetts)***, Pin: MA 02141 United States

USA Toll Free: +001-888-839-7392
USA Toll Free Fax: +001-888-839-7392

Offset Typesetting

Open Association of Research Society, Marsh Road, Rainham, Essex, London RM13 8EU United Kingdom.

Packaging & Continental Dispatching

Global Journals, India

Find a correspondence nodal officer near you

To find nodal officer of your country, please email us at *local@globaljournals.org*

eContacts

Press Inquiries: *press@globaljournals.org*
Investor Inquiries: *investers@globaljournals.org*
Technical Support: *technology@globaljournals.org*
Media & Releases: *media@globaljournals.org*

Pricing (Including by Air Parcel Charges):

For Authors:

22 USD (B/W) & 50 USD (Color)

Yearly Subscription (Personal & Institutional):

200 USD (B/W) & 250 USD (Color)

Editorial Board Members (HON.)

Contents of the Volume

Global Journal of Research In Engineering
Volume 11 Issue 5 Version 1.0 August 2011
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 Print ISSN: 0975-5861

Certain Results of Examination of Technical Stochastic Stability of A Car After Accident Repair

By Jerzy Kisilowski, Jarosław Zalewski

Warsaw University of Technology.

Abstract - This paper presents the chosen results of simulation of sports car mathematical model in different conditions of motion. The car model was loaded with the extra mass representing both driver and passenger. The location of the center of mass was disturbed, as if the car had previously been damaged due to side impact accident, and then repaired without the control of basis points in its body. It is shown how the car body can be damaged as a result of side crash at different velocity.

A simulation of double lane change was conducted as a maneuver of omitting a long obstacle. Different road conditions were taken into consideration, i.e. icy, uneven road. In further steps, some parts of road lane was divided into defined number of disjoined classes, which enabled us to find the frequency of the car remaining in each class. This, in turn will allow the examination of technical stochastic stability of car model and comparison with the definition according to ISO 8855:1991.

Keywords : *safety, stability, side impact, road accident.*

GJRE-B Classification : *FOR Code: 090204*

CERTAIN RESULTS OF EXAMINATION OF TECHNICAL STOCHASTIC STABILITY OF A CAR AFTER ACCIDENT REPAIR

Strictly as per the compliance and regulations of:

Certain Results of Examination of Technical Stochastic Stability of A Car After Accident Repair

Jerzy Kisilowski [α], Jarosław Zalewski [Ω]

Abstract - This paper presents the chosen results of simulation of sports car mathematical model in different conditions of motion. The car model was loaded with the extra mass representing both driver and passenger. The location of the center of mass was disturbed, as if the car had previously been damaged due to side impact accident, and then repaired without the control of basis points in its body. It is shown how the car body can be damaged as a result of side crash at different velocity.

A simulation of double lane change was conducted as a maneuver of omitting a long obstacle. Different road conditions were taken into consideration, i.e. icy, uneven road. In further steps, some parts of road lane was divided into defined number of disjoined classes, which enabled us to find the frequency of the car remaining in each class. This, in turn will allow the examination of technical stochastic stability of car model and comparison with the definition according to ISO 8855:1991.

Keywords : *safety, stability, side impact, road accident.*

I. Introduction

One of the most important issues concerning road traffic in recent times is the car, human and road active and passive safety. The scope of much research is the examination of different aspects of safety within the driver – car – surrounding system. The aim of this paper is to show the chosen results of examination of stochastic technical stability of a sports car mathematical model, with the consideration of the changes caused by the side impact crash and an after accident repair, as well as road conditions and disturbances coming from the road surface. Definition of stochastic technical stability is presented in [2], [3], [4] and [5]. In [1] the stability of discrete and continuous structures is presented, whereas in [9] – general mechanical criteria of retaining the stability by the car. These criteria are used in theory of road car dynamics. In [10] the mathematical description of the process of crash of vehicles is presented.

The necessity of conducting such research results, among others, from the statistical data. The authors concentrated on side impact accidents and their share in general number of accidents in Poland. Collisions were not analyzed.

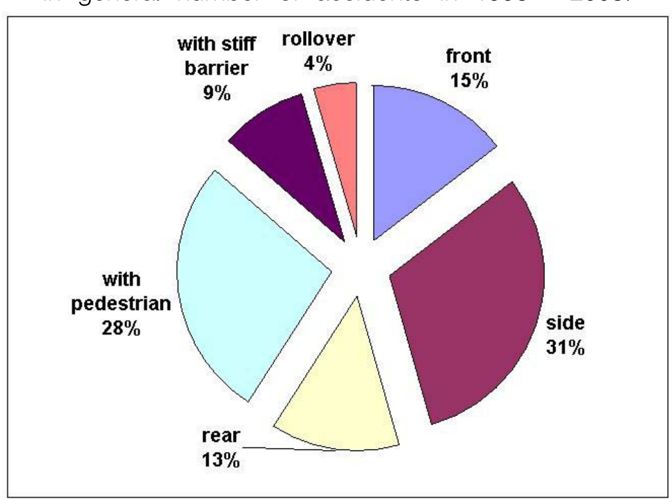
Author [α]: Warsaw University of Technology, Faculty of Transport.
Author [Ω]: Warsaw University of Technology Faculty of Administration and Social Science.

II. Chosen analysis of Road Accidents

In figure 2.1 percentage share of side impact crashes in general number of accidents is shown. This type of crashes establishes over 30 per cent of all accidents in Poland between 1995 and 2008. Taking into consideration the severity of injuries as well as deformations of car body, it is important to pay attention to both the reasons and the consequences of side impact crashes, which can occur in further exploitation of cars repaired after accident. There is often lack of control of geometric parameters of car body after repairing or changing the damaged parts.Statistics concerning road accidents with comments are also in [6], [8] and [11].

Taking into consideration what is mentioned above, the authors decided to focus on the analysis of side impact crash in the process of simulations (oblique location of the cars involved in accident in the moment of crash) and the examination of motion of the car, that was involved in this crash. The model of a sports car was chosen. Then the assumption was made, that neither the body of the chosen car was controlled on a special frame, nor its mass – inertia parameters were checked

Fig. 2.1 : Percentage share of different types of Crashes in general number of accidents in 1995 - 2008.

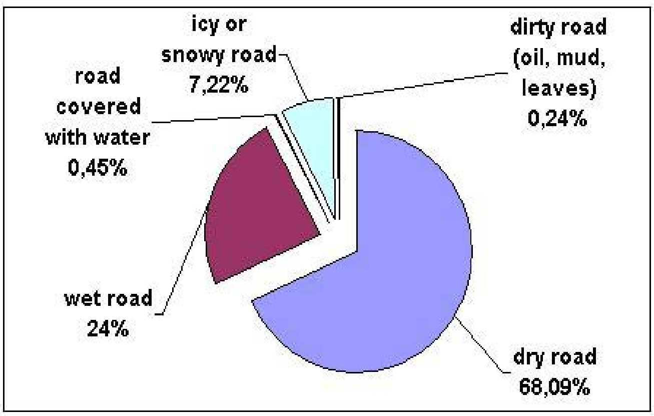


Source : own research.

Another factor taken into account during the preparation of the simulation were the extreme conditions of road traffic. Among the accidents, for example in 2005, around 36 per cent (fig. 2.2) occurred in bad road conditions (wet road, snow, dirt, oil, leaves on the road), 32 per cent during bad weather (fig. 2.3). It made the authors to implement similar conditions to the simulation. Randomly occurring unevenness of the road was also added.

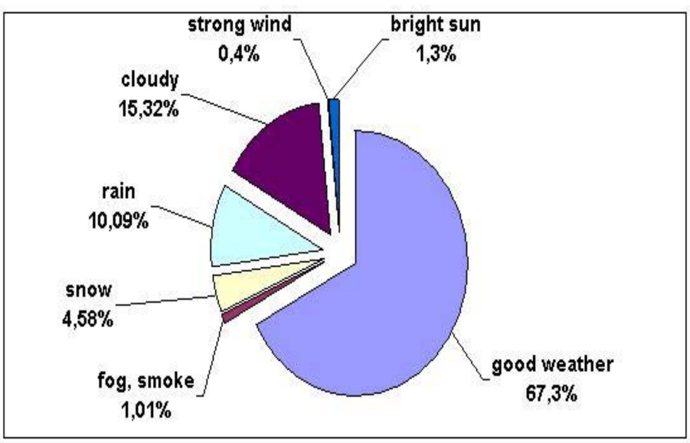
The additional simulation of side impact crash accident was done with the use of PC-Crash 8.0. Its purpose was to show deformations of a sports car body. The simulation of car motion after accident and repair was done with the use of MSC Adams 2005r2

Fig. 2.2 : Percentage share of accidents connected to road conditions in poland in 2005.



Source : own research.

Fig. 2.3 : Weather conditions during road accidents in Poland in 2005.



Source : own research

III. Simulation of Side Impact Crash in Pc Crash Software

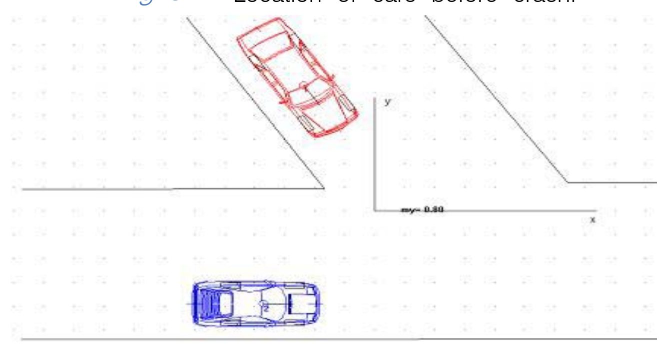
To examine the depth of deformation in car body as a result of side crash, a simulation in PC-Crash software was done with the relevant parameters. The situation reflects oblique side crash. The car being hit is Ferrari 355 GTS and the car hitting is Mercedes S500. Results of this simulation are shown for two sets of velocities of colliding cars. The authors would like to pay attention to potential deformations of a sports car body, which can occur as a result of side crash. It is also necessary to mention the consequences in the further exploitation of such car.

Basic assumptions concerning the simulation of the oblique side impact crash:

- the motion is set on a dry road surface ($\mu = 0{,}8$);
- the cars move with two sets of velocities:
a) Ferrari – 50km/h, Mercedes – 60km/h;
b) Ferrari – 80km/h, Mercedes – 100km/h;
- the whole mass of Ferrari was increased from 1350kg to 1500kg, adding the mass of the driver and the passenger;
- the whole mass of Ferrari was increased from 2100kg to 2395kg, adding the mass of the driver and three passengers;
- the height of the center of mass for Mercedes was set on 0,6m, for Ferrari - on 0,45m.

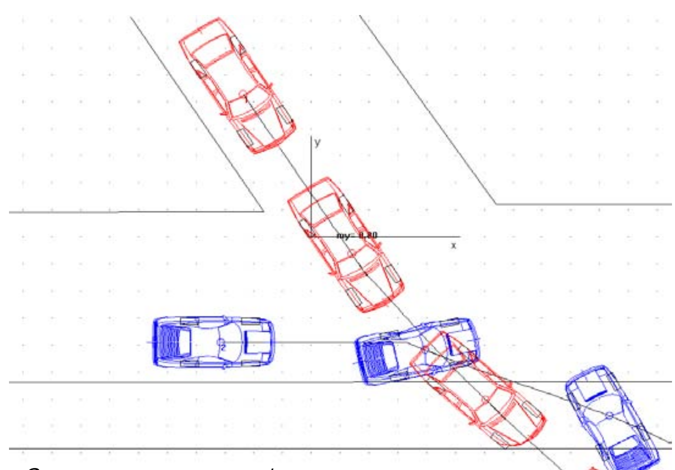
In fig 3.1 the location before the crash is presented, while in fig. 3.2 a, b – the motion of both cars during the crash as a sequential location of both cars for each set of velocities respectfully. Damages to the sports car body are shown in fig. 3.3a, b.

Fig. 3.1 : Location of cars before crash.



Source : own research

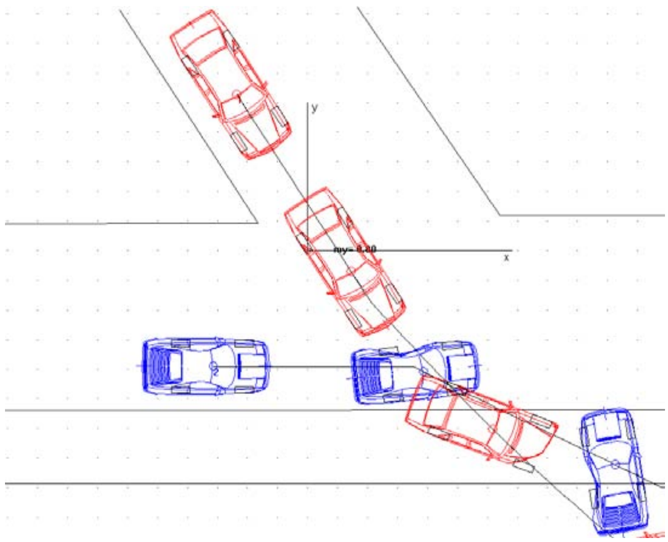
Fig. 3.2a : Simulation of oblique side impact crash for velocities 50km/h (Ferrari) and 60km/h (Mercedes).



Source : own research.

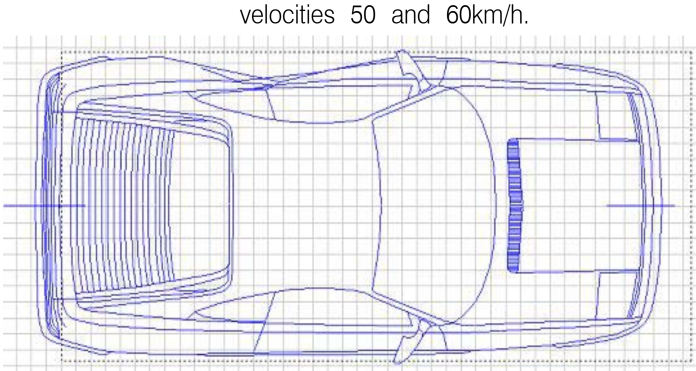
The simulation was realised for several times, during which the repetitiveness of the depth of deformations in car bodies was observed. Other parameters, for example velocities after the crash, differ in every simulation. However, the tolerance of such difference ranges from 2 to 5%, depending on if the car was hitting, or was being hit.

Fig. 3.2 a : Simulation of oblique side impact crash for velocities 80km/h (Ferrari) and 100km/h (Mercedes).



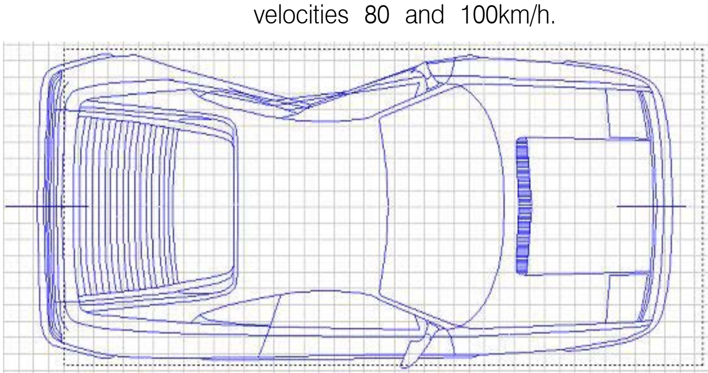
Source : own research.

Fig. 3.3 a : Deformation of the sports car body for the velocities 50 and 60km/h.



Source : own research.

Fig. 3.3b : Deformation of the sports car body for the velocities 80 and 100km/h.



Source : own research.

In table 3.1a i 3.1b exemplary protocols of both accidents for both velocity configurations are shown.

The depth of the deformations is worth noticing. At v = 60km/h, the hitting car (Mercedes) has its front deformed by 0,33m, and at v = 50km/h for Ferrari it is 0,25m in the left side part of its body. It is also important to consider the mutual penetration of both cars.

The results of the simulation for the second set of velocities present almost 0,6m deformation for Mercedes and 0,43m deformation of side part in Ferrari.

The authors are especially interested in the deformation of the sports car, because on such basis the scale of disturbances of the center of mass after repair of a damaged car can be assumed. It is due to the lack of control of geometric and inertia parameters of car body in the process of the elimination of damages.

Tab. 3.1a : Protocol of the side crash for velocities 50 and 60km/h.

car	Mercedes-Benz S 500	Ferrari - 355 Berlinetta
INITIAL VALUES OF PARAMETERS		
Before crash velocity [km/h]:	**60.00**	**50.00**
Angle of the car [deg] :	-57.43	0.00
Angular velocity around z axis [1/s] :	0.00	0.00
Location of cm in x axis [m] :	-2.36	-3.14
Location of cm in y axis [m] :	5.26	-3.91
Location of cm in z axis [m] :	0.60	0.45
Velocity along z axis [km/h] :	0.00	0.00
Lateral tilt [deg] :	0.00	0.00
Roll angle (around y axis)[deg] :	0.00	0.00
Angular velocity around x axis [1/s] :	0.00	0.00
Angular velocity around y axis [1/s] :	0.00	0.00
FINAL VALUES OF PARAMETERS		
After crash velocity [km/h]:	**48.05**	**55.86**
Velocity change dv [km/h] :	14.56	23.25
Angle of the car [st.] :	-41.31	168.94
Angular velocity around z axis [1/s] :	0.01	0.65
Location of cm in x axis [m] :	11.10	15.03
Location of cm in y axis [m] :	-10.84	-8.79
Location of cm in z axis [m] :	0.60	0.44
Velocity along z axis [km/h] :	0.03	0.17
Lateral tilt [deg] :	1.61	-1.52
Roll angle (around y axis) [deg] :	0.00	5.02
Angular velocity around x axis [1/s] :	-0.13	-0.70
Angular velocity around y axis [1/s] :	0.00	0.09
Depth of the deformations [m] :	0.33	0.25
Restitution coefficient k	0.10	

Source : own research.

Tab. 3.1b : Protocol of the side crash for velocities 80 and 100km/h.

Pojazd	Mercedes-Benz S-500	Ferrari 355-Berlinetta
INITIAL VALUES OF PARAMETERS		
Before crash velocity [km/h]:	**100.00**	**80.00**
Angle of the car [deg] :	-57.43	0.00
Angular velocity around z axis [1/s] :	0.00	0.00
Location of cm in x axis [m] :	-2.36	-3.14
Location of cm in y axis [m] :	5.26	-3.91
Location of cm in z axis [m] :	0.60	0.45
Velocity along z axis [km/h] :	0.00	0.00
Lateral tilt [deg] :	0.00	0.00
Roll angle (around y axis) [deg] :	0.00	0.00
Angular velocity around x axis [1/s] :	0.00	0.00
Angular velocity around y axis [1/s] :	0.00	0.00
FINAL VALUES OF PARAMETERS		
After crash velocity [km/h]:	**78.79**	**90.87**
Velocity change dv [km/h] :	26.54	42.38
Angle of the car [st.] :	92.37	- 179.59
Angular velocity around z axis [1/s] :	1.60	0.00
Location of cm in x axis [m] :	22.80	33.01
Location of cm in y axis [m] :	-19.54	-15.66
Location of cm in z axis [m] :	0.60	0.46
Velocity along z axis [km/h] :	0.08	-1.36
Lateral tilt [deg] :	8.18	-6.84
Roll angle (around y axis) [deg] :	-0.02	-1.75
Angular velocity around x axis [1/s] :	-0.03	0.30
Angular velocity around y axis [1/s] :	0.24	-0.21
Depth of the deformations [m] :	0.58	0.43
Restitution coefficient k	0.10	

Source : own research.

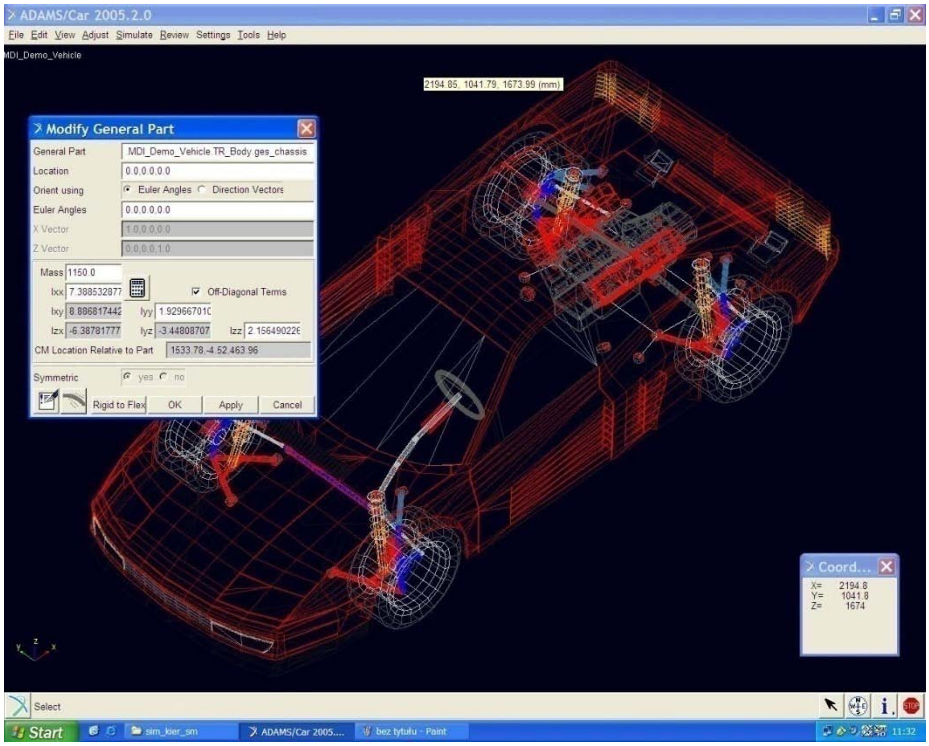
IV. Description of the Simulation of Car Mathematical Model with the Disturbed Center of Mass

The object of the simulation was the model of a sports car. For this model the mass and location of the driver and the passenger was included in the mass–inertial parameters. The model is shown in fig. 4.1.

The simulation, realizing the maneuver of double lane change was done with the use of MSC Adams/Car 2005r2 software. It was prepared for the conditions given below:

- additional mass representing the driver (85kg) and the passenger(70kg) was included;
- with the use of static moments new coordinates(x, y, z) of the center of mass of car body were calculated. Initial location of the center of mass was (1450.0mm, 0.0mm, 450.0mm) in relation to the point called "origo", which is the point of the beginning of the axis system that is situated on the road surface and moves with the car. The initial mass of the car body was 955kg. The location of the center of mass after adition of the driver and the passenger changed to (1533.78mm, -4.52mm, 463.96mm). The mass of the car body increased to 1150kg. The location of the center of mas is calculated in relation to the point called „origo", which lies at the beginning of the axis system connected to the road surface but moving along with the car. The location of coordinates (x,y) can also be calculated as in [4];
- disturbance was added to the coordinates calculated for the driver and the passenger. This disturbance is assumed to be a result of the previous crash and a possibility of the change of mass and moments of inertia. Two cases were taken into consideration. Basing on the results from p. 3 it was assumed, that in the process of repair the coordinates of the center of mass will not be restored to their initial location. No literature, describing the typical disturbances of the center of mass in car body after accident and repair, was found. New coordinates of the center of mass were defined as follows: x and y were transformed by 150mm, while the coordinate z – by 40mm (1383.78mm, 145.48mm, 503.96mm). As a result of those transformations new values of inertia and deviation moments were obtained;
- the car rides for 700m realizing the maneuver of double lane change. Omitting long obstacle was simulated here. The car moved at 100km/h, on the icy road surface ($\mu = \sim 0{,}30$);
  time of the maneuver t = 25s;
- two trajectories were obtained – a solid line for the car
- with additionally disturbed center of mass as a result of an accident, and a dash line for the car without after accident disturbances. In fig. 5.2 lateral displacement in function of time is shown for both the car with disturbed center of mass of its body by 150mm, and that with the undisturbed one.

Fig. 4.1 : Sports car model used in the simulation of motion.



Source : MSC Adams| Car.

V. Examination of Stochastic Technical Stability of Car Mathematical Model

The Ω set (the set containing the part of the trajectory in the range $[t_1;\ t_1+T]$) of the area of states E was divided into 10 classes every 50 mm: [K1; K10] (fig. 5.1a). In the plot road parameters and geometric parameters of the car were not taken into consideration.

The Ω' set (the set containing the part of the trajectory in the range $[t_1';\ t_1'+T']$) of the area of states E was divided into 10 classes every 50 mm: [K1'; K10'] (fig. 5.1b). On the axis of lateral displacement (x) the classes of both sets are marked.

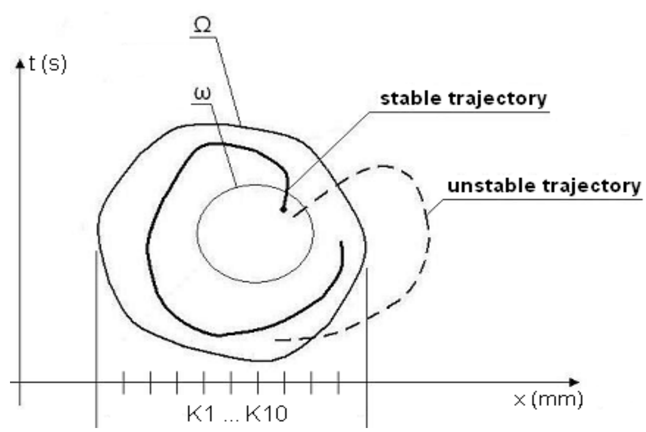
The frequencies of occurrences were counted for two areas:

- the area of omitting the obstacle $[t_1;\ t_1+T]$ – time frame [6s;16s] for every 10m of the road;
- final area, when the car finishes the maneuver $[t_1';\ t_1'+T']$ – time frame [22s; 25s] for every 10m of the road.

These time frames were divided into sub-frames with the step of $\Delta t = 0{,}375$s (fig. 5.2).

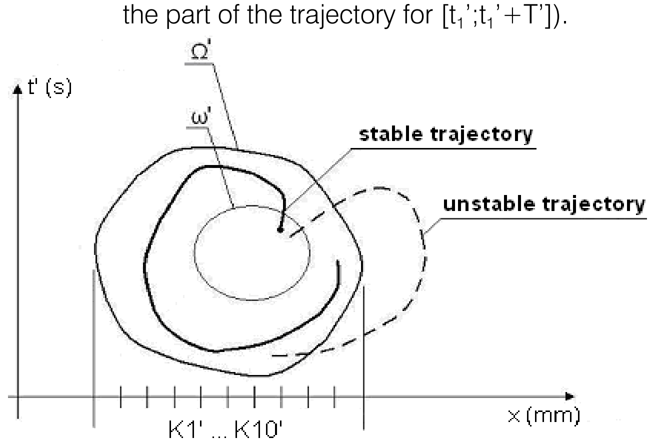
In fig. 5.3a, b the parts of trajectories from fig. 5.2 are shown, on which the frequencies of occurrences are examined, for the maneuver realized in the conditions of disturbing the horizontal coordinates of the center of mass in car body (respectively for $[t_1;\ t_1+T]$ and $[t_1';\ t_1'+T']$).

Fig. 5.1 a : Ω series in the area of states E containing the part of the trajectory for $[t_1;\ t_1+T]$).



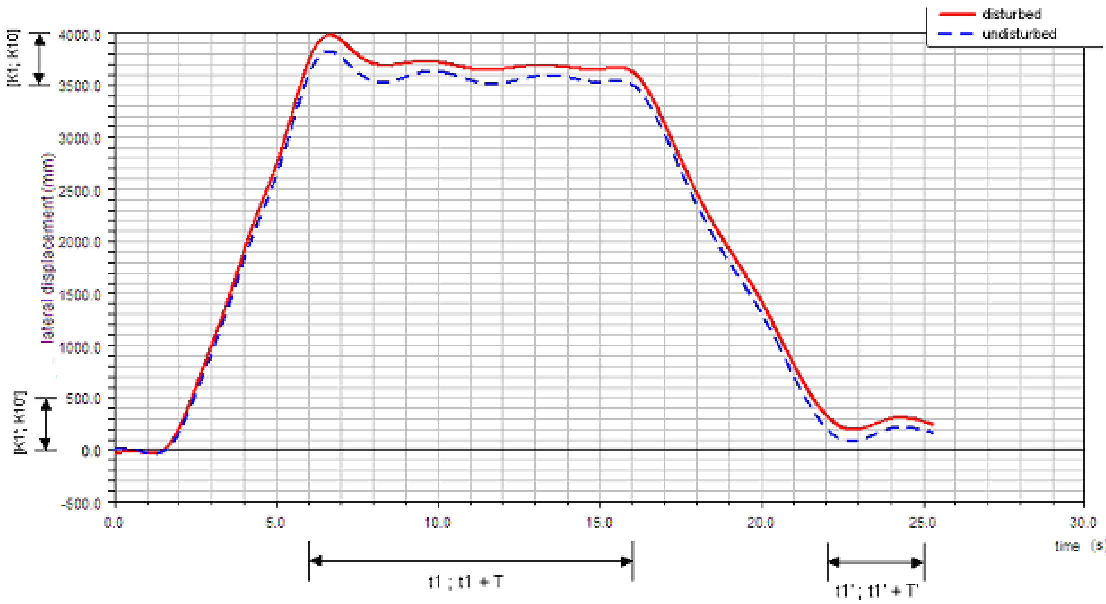
Source : own research.

Fig. 5.1 b : Ω' series in the area of states E containing the part of the trajectory for $[t_1';t_1'+T']$).



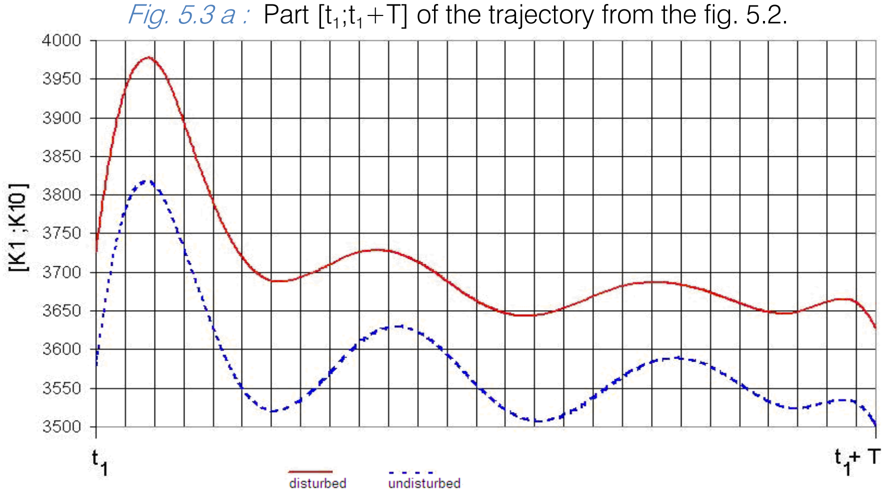
Source : own research.

Fig. 5.2 : Lateral displacement of the car with the disturbed by 150 mm (solid line) and undisturbed (dashed line) center of mass of its body.



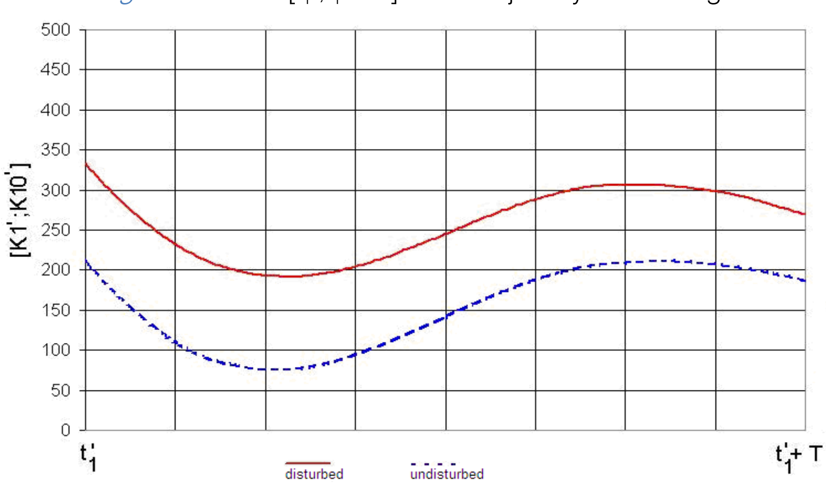
Source: own research

Fig. 5.3 a : Part [t_1;t_1+T] of the trajectory from the fig. 5.2.



Source : own research.

Fig. 5.3 b : Part [t_1';t_1'+T'] of the trajectory from the fig.5.2.



Source : own research.

VI. Results

Analysis was made for the time frame $[t_1; t_1+T]$. The frequencies of occurrences were counted as follows. In every step of the time frame the frequencies of existence of the solution in each class were examined. Basing on [3]

$$W(K_j) = \frac{T_{Kj}}{T} = \frac{N_{Kj} \cdot \Delta t}{N \cdot \Delta t} = \frac{N_{Kj}}{N} \qquad (5.1)$$

where:

T_{Kj} - time of remaining in the given class;

- N_{Kj} - the number of sub-frames, for which the solution remains in the given class.

The values of the frequencies of occurrences are presented in tab. 6.1 – 6.2. Kolmogorov – Smirnov test (λ test) was performed in order to verify the H_0 hypothesis about the incompatibility of the step curve and the continuous probability on the significance level α=0,05. D_n, D_x, D_n' and D_x' here mean the Kolmogorov – Smirnov statistics. Normal and Rayleigh means were analyzed.

Tab. 6.1 : Verification of the hypothesis on the basis of λ test for the step curve and the continuous probability for [t1; t1+T], without disturbances, normal and Rayleigh means.

class	N_{Kj}	W(Kj)	step curve F(Kj)	continuous probability (normal means) F(u)	D_n	critical value	λ test (α =0,05)	N_{Kj}	W(Kj)	step curve F(Kj)	continuous probability (Rayleigh means) F(x)	D_x	critical value	λ test (α = 0,05)
1	12	0,445	0,445	0,98745	0,54245	0,37543	hypothesis accepted	12	0,445	0,445	0,98515	0,54015	0,37543	hypothesis accepted
2	8	0,296	0,741	0,99998	0,25898	0,45427	hypothesis rejected	8	0,296	0,741	0,99999	0,25899	0,45427	hypothesis rejected
3	4	0,148	0,889	1	0,111	0,62394	hypothesis rejected	4	0,148	0,889	1	0,111	0,62394	hypothesis rejected
4	0	0	0,889	1	0,111	-	-	0	0	0,889	1	0,111	-	-
5	1	0,037	0,926	1	0,074	0,97500	hypothesis rejected	1	0,037	0,926	1	0,074	0,97500	hypothesis rejected
6	1	0,037	0,963	1	0,037	0,97500	hypothesis rejected	1	0,037	0,963	1	0,037	0,97500	hypothesis rejected
7	1	0,037	1	1	0	0,97500	hypothesis rejected	1	0,037	1	1	5,84E-10	0,97500	hypothesis rejected
8	0	0	1	1	0	-	-	0	0	1	1	5,84E-10	-	-
9	0	0	1	1	0	-	-	0	0	1	1	5,84E-10	-	-
10	0	0	1	1	0	-	-	0	0	1	1	5,84E-10	-	-

Source : own research.

Tab. 6.2 : Verification of the hypothesis on the basis of λ test for the step curve and the continuous probability for [t1; t1+T], with disturbances of the center of mass by 150mm, normal and Rayleigh means.

class	N_{Kj}	W(Kj)	step curve F(Kj)	continuous probability (normal means) F(u)	D_n	critical value	λ test (α = 0,05)	N_{Kj}	W(Kj)	step curve F(Kj)	continuous probability (Rayleigh means) F(x)	D_x	critical value	λ test (α = 0,05)
1	0	0	0	0,25462	0,25462	-	-	0	0	0	0	0	-	-
2	0	0	0	0,25462	0,25462	-	-	0	0	0	0	0	-	-
3	5	0,185	0,185	0,71226	0,52726	0,56328	hypothesis rejected	5	0,185	0,185	0,52608	0,34108	0,56328	hypothesis rejected
4	13	0,482	0,667	0,99990	0,33290	0,36143	hypothesis rejected	13	0,482	0,667	0,99993	0,33293	0,36143	hypothesis rejected
5	5	0,185	0,852	0,99999	0,14799	0,56328	hypothesis rejected	5	0,185	0,852	1	0,148	0,56328	hypothesis rejected
6	1	0,037	0,889	1	0,111	0,97500	hypothesis rejected	1	0,037	0,889	1	0,111	0,97500	hypothesis rejected
7	1	0,037	0,926	1	0,074	0,97500	hypothesis rejected	1	0,037	0,926	1	0,074	0,97500	hypothesis rejected
8	0	0	0,926	1	0,074	-	-	0	0	0,926	1	0,074	-	-
9	1	0,037	0,963	1	0,037	0,97500	hypothesis rejected	1	0,037	0,963	1	0,037	0,97500	hypothesis rejected
10	1	0,037	1	1	2,22E-16	0,97500	hypothesis rejected	1	0,037	1	1	3,35E-10	0,97500	hypothesis rejected

Source : own research.

VII. Conclusions

The examination of stochastic technical stability was made within two aspects. Trajectories of car motion and the frequencies of the occurrence of deviation from the initial location were compared. The analysis was made for the trajectories of motion after the double lane change maneuver and returning to initial lane.

If, according to fig. 5.1a and 5.1b, the area in which the trajectory can occur is divided into 10 equal sections, then for time $[t_1;\ t_1+T]$ it can be specified, whether the trajectories will leave this area. For such criteria the trajectories, after omitting the obstacle, remain in Ω area.

Maximal values of amplitudes of the trajectories for the car with the center of mass disturbed are near the border of stability, according to the accepted criteria. We believe that if the disturbances are increased, the trajectory will leave the Ω area.

Another scope of the conclusions concerns the frequencies of occurrence of the trajectories in the specified sections. As seen in tab. 6.1 and 6.2, the frequencies of occurrences in classes 4 and 5 are much higher for the trajectory of the car with the disturbed center of mass. For example, in class 4, for the car with the undisturbed center of mass the frequency of occurrences is zero, whereas for the car with the disturbed center of mass it is 0,482. In class 5 it is 0,037 and 0,185 respectively.

Maximal amplitude values of the trajectory for the car with the undisturbed center of mass for in classes 9 and 10 are zero, and for the car with the disturbed center of mass 0,037 in both classes.

As it is seen, the disturbances of the center of mass meaningly influences both the maximal values of amplitudes of the trajectories and the frequencies of occurrences in class for high amplitudes of trajectories.

VIII. Bibliography

1. Gutowski R., The basics of stability of discreet and constant systems, Warsaw 1981, Warsaw University of Technology. (in Polish)
2. Bogusz W., Technical stability, Warsaw 1972, PWN. (in Polish)
3. Kisilowski J., Kardas-Cinal E., On a Certain Method of Examining Stability of Mathematical Models of railway Vehicles with Disturbances Occurring in Real Objects, VSD Suplement to vol. 23, Proceedings of 13th IAVSD Symposium held in Chengdu, Sichuan, P. R. China, August 23 – 27, 1993.
4. Kisilowski J., Choromański W., Łopata H., Investigation of Technical Stochastic Stability of Lateral Vibrations of Mathematical Model of Rail Vehicle, Engineering Transactions, Polish Academy of Sciences – IPPT, Vol.33, Warsaw 1985.
5. Kisilowski J., Zalewski J., On a certain possibility of practical application of stochastic technical stability, Maintenance and Reliability, 1(37)/2008, p. 4.
6. Rajchel K.: Prawo drogowe, wypadki, Rzeszów, 1998, Politechnika Rzeszowska. (in Polish)
7. Reimpell J.: Vehicle chassis. The basics of construction, Warsaw 2004, WKŁ. (in Polish)
8. Szczuraszek T.: Bezpieczeństwo ruchu drogowego, Warszawa 2005, WKŁ. (in Polish)
9. Wicher, J.: Bezpieczeństwo samochodów i ruchu drogowego, Warszawa 2003, WKŁ. (in Polish)
10. Wicher J., Stawicki R., Modelowanie zderzenia samochodów, Zeszyty Naukowe Instytutu Pojazdów, PW, SIMR, 1999, JII.01640, nr 1(31)/99. (in Polish)
11. Witan M.: Ocena powstawania szkód komunikacyjnych w warunkach ruchu poza terenem zabudowanym, Praca Magisterska, Politechnika
12. Warszawska, Warszawa 2006. (in Polish)

Global Journal of Research In Engineering
Automotive Engineering
Volume 11 Issue 5 Version 1.0 August 2011
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 Print ISSN: 0975-5861

Operating Experience and Analysis of Engine Operated on Ethanol - Diesel Emulsion

By S.Peniel Pauldoss, Syed Ummer M. Thangal
Research scholar, Karunya University, India.

Abstract - Ethanol is a bio-based renewable and oxygenated fuel, thereby providing potential to reduce the PM emission in diesel engines and to provide reduction in life cycle CO_2. Although ethanol has been used as fuels oxygenate to reduce tail-pipe emissions in gasoline, its use in diesel has been limited due to technical limitations (i.e., blending). Commercially viable e-diesel is now possible due to the development of a new additive system. Tetra Methyl Ammonium Bromide, a new additive allows the splash blending of ethanol in diesel. The objective of this investigation is to first create a stable ethanol-diesel emulsified fuel with 2% Tetra Methyl Ammonium Bromide additive, and then to generate transient performance, combustion and emissions data for evaluation of different ethanol content on a diesel engine. A single-cylinder, air-cooled, direct injection diesel engine developing a power output of 5.2 kW at 1500 rev/min was used. Base data was generated with standard diesel fuel. Subsequently three fuel blends, namely 80D: 20E, 75D: 25E, 70D: 30E and 65D: 35E by volume were prepared and tested. Engine performance and emission data were used to optimize the blends for reducing emission and improving performance. Results show almost equal performance for 90D: 10E blends with reduced emissions compared to neat fuel.

Keywords : Oxygenated fuel, additive, alternate fuels, performance and emission.

OPERATING EXPERIENCE AND ANALYSIS OF ENGINE OPERATED ON ETHANOL - DIESEL EMULSION

Strictly as per the compliance and regulations of:

Operating Experience and Analysis of Engine Operated on Ethanol - Diesel Emulsion

S.Peniel Pauldoss[α], Syed Ummer M. Thangal[Ω]

Abstract - Ethanol is a bio-based renewable and oxygenated fuel, thereby providing potential to reduce the PM emission in diesel engines and to provide reduction in life cycle CO_2. Although ethanol has been used as fuels oxygenate to reduce tail-pipe emissions in gasoline, its use in diesel has been limited due to technical limitations (i.e., blending). Commercially viable e-diesel is now possible due to the development of a new additive system. Tetra Methyl Ammonium Bromide, a new additive allows the splash blending of ethanol in diesel. The objective of this investigation is to first create a stable ethanol-diesel emulsified fuel with 2% Tetra Methyl Ammonium Bromide additive, and then to generate transient performance, combustion and emissions data for evaluation of different ethanol content on a diesel engine. A single-cylinder, air-cooled, direct injection diesel engine developing a power output of 5.2 kW at 1500 rev/min was used. Base data was generated with standard diesel fuel. Subsequently three fuel blends, namely 80D: 20E, 75D: 25E, 70D: 30E and 65D: 35E by volume were prepared and tested. Engine performance and emission data were used to optimize the blends for reducing emission and improving performance. Results show almost equal performance for 90D: 10E blends with reduced emissions compared to neat fuel.

Keywords : Oxygenated fuel, additive, alternate fuels, performance and emission.

I. Introduction

Reducing the emissions and fuel consumption are no longer future goals instead they are the demands of the day. Indiscriminate extraction and increased consumption of fossil fuels have led to the reduction in carbon based resources. Alternative fuels promise to harmonize sustainable development, energy conservation, efficiency management and environmental preservation. Diesel engines have the advantages of high thermal efficiency lower emission of CO and HC. However, they have the disadvantage of producing smoke, particulate matter & oxides of nitrogen and it is difficult to reduce both NOx, and smoke density simultaneously in diesel engine due to trade off between NOx and smoke. It follows therefore, that substantial amount of effort has been directed at providing solutions to these problems. Among various developments to reduce emissions, the application of oxygenated fuels to diesel engines is an effective way to reduce smoke emissions. The potentiality of oxygenated fuels to suppress soot precursor formation is dominated by molecular structure as well as fuel oxygen contents [1]. When oxygen content in the fuel reaches approximately 30% by mass, smokeless combustion in diesel engines could be realized [2]. Since ethanol is a widely available oxygenate with a long history of use in gasoline blends it has also been considered as a potential oxygenate for diesel fuel blending. Researchers have investigated the use of ethanol in diesel engines over the past several decades. The limited miscibility at lower temperature, less heating value, poor lubricating properties and the required minor variations in fuel delivery systems restrict the use of ethanol in diesel fuel [3]. Also the addition of ethanol to diesel fuel decreases the blend's viscosity and causes cetane number of the blends linear reduction at ambient temperature [4]. Usually, when ethanol content in the blends reaches 20–40%, high concentration of additives are needed to ensure the mixture homogeneity in the presence of high water contents, and to attain the required cetane number for suitable ignition [5],[6]. Literary survey revealed that several oxygenated organic compounds (ether, amino alcohols, surfactants etc….) may be used as additives and when the ethanol concentration increases beyond 20%, high concentrations of additives needed to stabilize the mixture. Choosing unsuitable organic additive meets with several difficulties viz; immiscible fuel-alcohol blends, difficulty to handle, high cost etc., [7] [8] [9].

C. Sundar Raj et al investigated the effect of 1, 4 dioxane on ethanol diesel blends and reported even though 10% dioxane is capable to stabilize 30% ethanol with 60% diesel with significant reductions in emissions, 70% diesel- 20% ethanol with 10% dioxane is the optimum mixture [10].

Diesel-ethanol emulsion stabilized by 2% Tetra Methyl Ammonium Bromide is investigated in this study. Each of the different ethanol proportions were mixed with diesel in different percentages by volume (20%, 25%, 30% & 35%). The mixture was then kept for 5 days during which constant stirring were carried out. This was done so as to allow maximum amount of the oil to become dissolved. After this the mixture was thoroughly filtered to remove any undissolved particles. It was absorbed that there is a colour change in the fuel. The above fuel solution was then tested in a CI engine to determine its performance an emission characteristics.

II. Fuel Properties of Diesel, Ethanol

General fuel properties of diesel and ethanol are presented in Table 1.

Author[α]: Research scholar, Karunya University, India.
E-mail : ppauldoss@yahoo.com
Author[Ω]: Associate Professor in Mechanical Engineering, Karunya University, India. E-mail : syed@karunya.edu

TABLE 1 CHEMICAL PROPERTY OF DIESEL, AND ETHANOL	Molecular Formula	Molecular weight	Density at 20 °C ($\times 10^3$kg/m^3)	Boiling point (°C)	Flash point (°C)	Viscosity (mPa s)	Cetane Number	% of oxygen by weight
Diesel[a]	C_xH_y	190–220	0.829	180–360	65–88	3.35	45–50	0
Ethanol[b]	C_2H_6O	46.07	0.789	78.4	13	1.20	8	35

a. Table on Gasoline and Gasohol from Alcohols and Ethers, API Publication 4261, Second Edition (July 1988)
b. http://en.wikipedia.org/wiki/Ethanol

III. Parameter Tested and Experimental Procedure

Experiments were conducted on Kirloskar TV1, Four stroke, single cylinder, and air cooled diesel engine. The rated power of the engine was 5.2kw at 1500 rpm. The engine was operated at a constant speed of 1500 rpm and standard injection pressure of 200 bars. The fuel flow rate was measured on volume basis using a burette and a stop watch. K-type thermocouple and a digital display were employed to note the exhaust gas temperature. AVL smoke meter was used for measurement of smoke density. NOx emission was measured by AVL digas analyzer. In cylinder pressure was measured with help of AVL combustion analyzer. The schematic experimental setup is shown in Fig. 1.

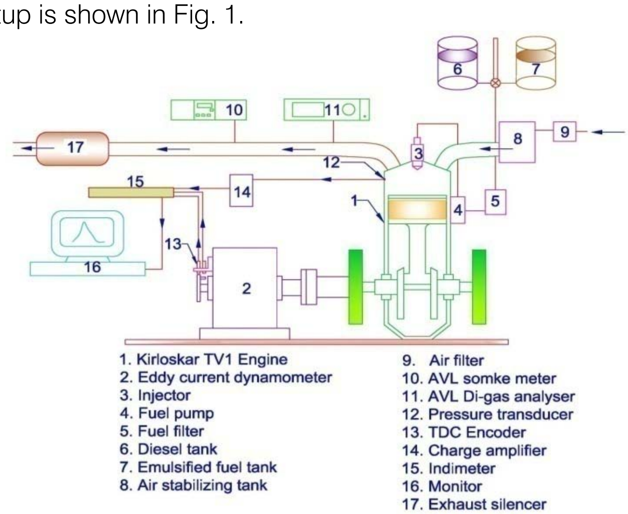


Fig. 1 : Experimental set up

IV. Results and Discussions

a) Performance Parameters

The lower heat value of the ethanol makes heat value of the mixture to decrease and hence the BSFC to increase for higher blends. Fig. 2 shows the brake specific fuel consumption for different ethanol additions at peak load. Among the blends 10% ethanol shows minimum brake specific fuel consumption to other blends. Increase in BSFC at higher blends indicates that there is no cavitation due to ethanol additions.

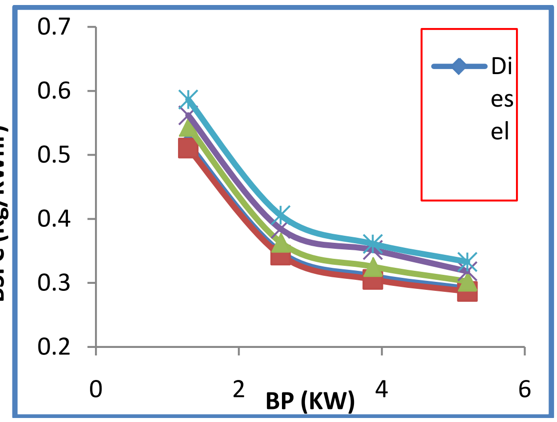


Fig. 2 : Breake specific fuel consumption for different ethanol concentration

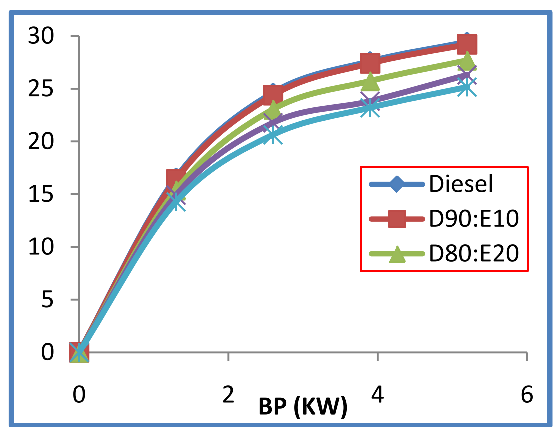


Fig. 3 : Breake thermal efficiency for different ethanol Concentration

Fig. 3 shows the brake thermal efficiency for different ethanol additions. From the figure it is observed that the brake thermal efficiency of 10% ethanol blends recorded a maximum of 30.5% efficiency. Improvement in combustion, especially diffusion combustion due to the increase in oxygen concentration from ethanol in the fuel is the reason for this increase in brake thermal efficiency. However, decrease in heat value of the blend makes the efficiency to decrease for higher blends.

b) Emission Parameters

The variation of smoke density with respective engine brake power is shown in Fig. 4. The addition of ethanol, decrease the smoke density especially between part loads to peak load. Addition of ethanol reduces smoke density uniformly at peak load because of the decreased quenching distance and the increased lean flammability limit due to the high combustion temperature. The presence of oxygen in the fuel assists in permitting the oxidation reactions to proceed close to completion. The results reveal that the tendency to generate soot from the fuel-rich regions inside diesel diffusion flame is decreased by ethanol in the blends. 16% reduction of smoke was observed for 90D: 10E blend ratio compared with the neat fuel.

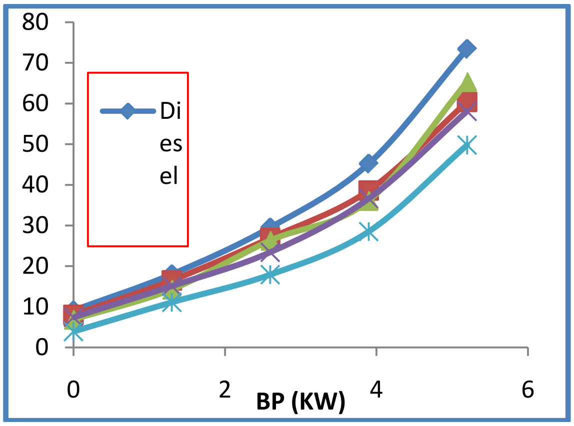


Fig. 4 : Veriation of smoke density for different ethanol concentration

The presence of oxygen increases the heat release rate for the oxygenated fuel and hence the NOx emission will be high. The anticipated increase in NOx emissions as a function of increasing ethanol concentration is apparent in Fig. 5. Nitrogen oxides emissions are predominately temperature phenomena. It can be seen that NOx emissions of all blends increase more rapidly than those of neat fuel as ethanol proportion and load increase at medium and high loads. The maximum increase in NOx emissions occur at 80~100% full load conditions because of long ignition delay and rich oxygen circumstance from ethanol in the mixture.

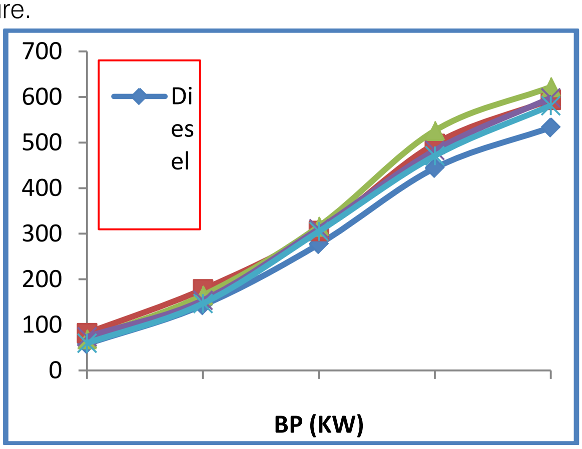


Fig. 5 : Veriation of NOx emmissions for different ethanol concentration

b) Combustion Parameters

Oxygen molecules presented in ethanol increase the spray optimization and evaporation and hence the combustion process of the engine. Fig. 6 illustrates cylinder pressure traces for different ethanol blended diesel fuels for various conditions of the engine. A peak pressure of 74 bars for 10% ethanol blend was recorded while it was 68 bars for neat fuel. The oxygenated fuel engine has longer delay period compared to neat fuel.

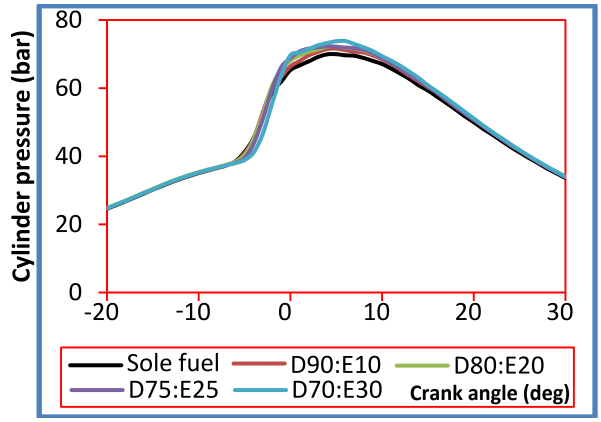


Fig. 6 : Cylinder pressure for different crank angle.

Fig. 7 illustrates heat release rate of the oxygenated fuel blends and neat fuel at different crank angle. The heat release rate is high for oxygenated fuels due to the longer duration of the combustion. It can be seen that heat release rate curves of the oxygenated fuel blends and neat fuel show similar pattern. The reason is the rate of diffusion combustion of the oxygenated fuel increases the heat release rate and consequently oxygenated fuel has controlled rate of pre-mixed combustion.

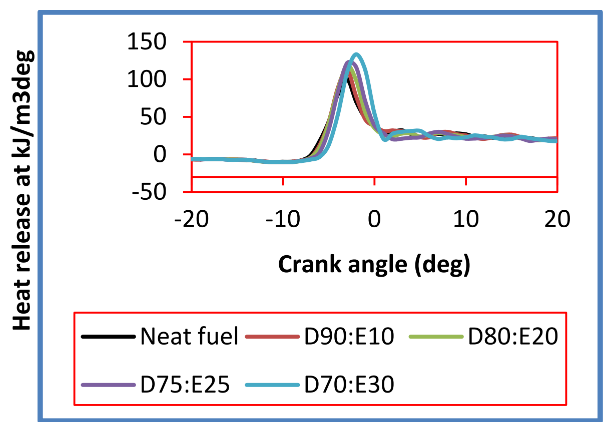


Fig. 7 : Heat release rate for different crank angle.

V. Conclussions

The results of the present study may be summarized as follows,

- Addition of 2% Tetra Methyl Ammonium Bromide as surfactant can stabilize up to 30% ethanol with diesel.
- The specific fuel consumption decreases with increase in ethanol blend in diesel fuel but 90D: 10E shows lower specific fuel consumption.
- Brake thermal efficiency decreases with increase in ethanol ratio. However, 90D: 10E shows equal performance compared with neat fuel.
- Considerable amount of smoke reduction with a

little penalty in NOx was resulted

- Maximum cylinder pressure and heat release rate for blends were found to be increased.

On the whole it is concluded that 2% addition of Tetra Methyl Ammonium Bromide by virtue of its properties is capable to stabilize 30% ethanol with 70% diesel by volume, and 10% ethanol diesel emulsion can be used in a compression ignition engine with significant reduction in exhaust emissions as compared to neat diesel without any engine modifications.

References Références Referencias

1. Kitamura T, Ito T, Senda J. Fujimoto H., Extraction of the suppression effects of oxygenated fuels on soot formation using a detailed chemical kinetic model, JSAE Review, 2001, 22, 139-145.
2. Miyamoto N, Ogawa H, Nurun N.M., Obata K, Arima T., Smokeless, low NOx high thermal efficiency and low noise diesel combustion with oxygenated agents as main fuel, SAE, 1998, 980506.
3. Brinkman ND., Ethanol Fuel - A Single-Cylinder Engine Study of Efficiency and Exhaust Emissions, SAE, 1981, 810345.
4. Stage de Caro P, Mouloungui Z, Vaitilingom G, Berge J.C., Interest of combining an additive with diesel-ethanol blends for use in diesel engines, Fuel, 2001, 80, 565 – 74.
5. Bang-Quan H, Jian-Xin W, Xiao-Guang Y, XinTian H.C., Study on combustion and emission characteristics of diesel engines using ethanol-blended diesel fuels, SAE, 2003, 2003-01-0762.
6. Xingcai L, Zhen H, Wu-gao Z, Degang L., The influence of ethanol additives on the performance and combustion characteristics of diesel engine. Journal of Combust Sci. Technol., 2004, 176, 1309 – 29.
7. Li D, Zhen H, Xingcai L, Wu-gao Z, Jian-guang Y., Physico –Chemical properties of ethanol diesel blends fuel and its effect on performance and emission of diesel engine, Journal of Renewable energy, 2005, 30, 67 – 76.
8. Rakopoulos C. D, Antonopoulos K. A, Rakopoulos D. C, Hountalas D. T., Multi zone modeling of combustion and emissions formulation in a DI diesel engine operating on ethanol, diesel fuel blends. Journal of Energy conversion management, 2008, 49, 625- 43.
9. Gong R, Liu S, Guo H, Hu T, Ahou L., A new diesel oxygenated additive and its effects on engine combustion and emission. Journal of Applied Thermal Engineering, 2007, 27, 202 - 207.
10. Sundar Raj,C. Arul, S. ,Sendilvelan, S.,Saravanan, C.G. (2009). Effect Of 1, 4 Dioxane Ethanol Diesel Blends On Diesel Engine", *International Journal of Engineering Research and Industrial Applications (IJERIA)*, 2(V), 197-208.

Global Journal of Research In Engineering
Automotive Engineering
Volume 11 Issue 5 Version 1.0 August 2011
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 Print ISSN: 0975-5861

Online Tool Wear Prediction Models in Minimum Quantity Lubrication

By S.Narayana Rao, Dr. B.Satyanarayana, Dr. K.Venkatasubbaiah
GITAM University, Visakhapatnam, India.

Abstract - With the problems in usage of cutting fluids, the use of Minimum Quantity Lubrication (MQL) has gained prominence. Though several mathematical models have been postulated in literature on dry cutting, models that deal with cutting fluids are very rare and the models on MQL are seldom found. The present work tries to discuss regression and artificial neural network models postulated on influence of MQL on tool wear, while machining AISI 1040 steel using HSS tool. The proposed models were validated with the experimental results.

Keywords : tool wear; MQL; cutting fluids; regression model; artificial neural networks.

GJRE-B Classification: FOR Code: 860603

ONLINE TOOL WEAR PREDICTION MODELS IN MINIMUM QUANTITY LUBRICATION

Strictly as per the compliance and regulations of:

Online Tool Wear Prediction Models in Minimum Quantity Lubrication

S.Narayana Rao[α], Dr.B.Satyanarayana[Ω], Dr.K.Venkatasubbaiah[β]

Abstract - With the problems in usage of cutting fluids, the use of Minimum Quantity Lubrication (MQL) has gained prominence. Though several mathematical models have been postulated in literature on dry cutting, models that deal with cutting fluids are very rare and the models on MQL are seldom found. The present work tries to discuss regression and artificial neural network models postulated on influence of MQL on tool wear, while machining AISI 1040 steel using HSS tool. The proposed models were validated with the experimental results.

Keywords : tool wear; MQL; cutting fluids; regression model; artificial neural networks

I. INTRODUCTION

Given the current state of manufacturing industry, the ability to develop robust products with the help of cost-effective techniques are necessary to meet the challenges of a dynamic and ever-changing sector. This is particularly true for production processes, where the idle and down times arising from various factors prove to be one of the major impediments in achieving the goal [1, 2].

In terms of the cost factors, machining is considered as one of the most important of the manufacturing processes. The associated machine downtimes are mainly attributed to the frequent replacement of worn tools. Hence, the prime focus for researchers to reduce the downtimes and achieve cost-effectiveness resides in the estimation of tool life and the investigation of remedial measures for tool wear.

A key factor that affects the wear rate of tools is the temperature reached during the cutting operation along with the applied forces. Reduction in tool wear can be readily accomplished by using cutting fluids that can act both as lubricants and as coolants while machining. Water miscible oils prove to be the most promising and popular cutting fluids used, owing to the confluence of cooling properties of water and lubricating abilities of oil. Despite numerous advantages, their usage is restricted because of the microbial contamination that poses health hazards to the workers, and associated problems with their disposal. This has given rise to several alternatives including Minimum Quantity Lubrication (MQL).

To assess tool wear online, different methodologies are reported in literature. A majority of the models consider different cutting parameters and predict tool wear either using mathematical models or artificial neural networks.

Mathematical models have been proposed to help evaluation of tool wear under different conditions [1, 3 and 4].

Rao [5] developed a mathematical formulation to estimate tool flank wear online through the estimation of cutting forces. Relation for predicting radial component of cutting forces from various measured machining parameters was developed.

Theoretical and experimental studies were carried out by Luo et al [6] to investigate the intrinsic relationship between tool flank wear and operational conditions in metal cutting processes using carbide cutting inserts. A flank wear rate model, which combines cutting mechanics simulation and an empirical model, was developed to predict tool flank wear land width. Machining was done under different operational conditions using hard metal coated carbide cutting inserts. The results of the experimental studies indicated that cutting speed had a more dramatic effect, than feed rate, on tool life. The wear constants in the proposed wear rate model were determined by regression analysis using the machining data and simulation results. A close agreement between the predicted and measured tool flank wear land width was reported.

Ozel and Karpat [7] studied the predictive modeling of surface roughness and tool wear in hard turning using regression and neural networks. The cutting tool used was cubic boron nitride. In this study, effects of cutting edge geometry, workpiece hardness, feed rate and cutting speed on surface roughness and tool wear were experimentally investigated. A four factor-two level fractional factorial design was used. Exponential model for surface roughness and tool flank wear for hard turning of AISI 52100 steel using CBN tools were proposed. The tool wear model was given as:

$$VB = K_2\, C^{a1} V^{b2} L^{c3} \tag{1}$$

Exponential regression models for surface roughness and tool flank wear were given, respectively, for finish hard turning of AISI H13 steel using CBN tools (Eq.2.2 & 2.3).

$$R_a = K_1\, H^{a1} E^{b1} V^{c1} f^{d1} L_C^{\ e1} \tag{2}$$

$$VB = K_2\, H^{a1} E^{b1} V^{c1} f^{d1} L_C^{\ e1} \tag{3}$$

where 'K_1' and 'K_2' are proportionality constants, 'C' is CBN content of tool in percentage volume, 'V' is cutting speed, 'f' is feed, 'L_C' is cutting length in axial

Author [α] : Dept. of Industrial Production Engg., GIT, GITAM University, Visakhapatnam, India. E-mail : nrsambana8888@gmail.com
Author [Ω]: Dept. of Mechanical Engg., AU College of Engineering, Andhra University, Visakhapatnam, India

direction, 'H' is work material hardness and 'E' is edge radius of CBN tool.

Srikant [8] modeled tool wear in wet machining with cutting fluids of different emulsifier contents. The model was formulated as:

$$VB = 0.277 \times (\upsilon^{1.4} \; t_m^{0.109} \; F_C^{0.623} \; H^{0.669}) / (R_a^{1.6} k^{1.3} T_C^{1.3}) \quad (4)$$

where VB is tool wear, υ is kinematic viscosity of the fluid, t_m is machining time, F_C is cutting force, H is hardness of the machined surface, R_a is the surface roughness, k is thermal conductivity and T_C is the cutting temperature. An average Regression coefficient of 0.85 was reported. However, the model was developed only for conventional lubrication and not MQL.

In recent years, the use of artificial neural networks (ANN) for the monitoring of tool wear has proved to be extremely successful. In the conventional system, the operator learns by his experience and tries to take decisions based on his past experiences. This learning is due to the processing of the external data or stimulus by the neurons in the brain to produce the reaction. Artificial neural networks imitate this learning behavior of the human brains. The network learns with the obtained data and takes decisions based on learning data. Many researchers tried Neural Networks to monitor the tool wear and obtained encouraging results.

S.Purushothaman and Srinivasa [9] trained a multi-layer perceptron with back propagation algorithm with 30 patterns of 6 inputs each consisting of speed, feed, depth of cut and the cutting forces in three directions. The outputs were the flank wear, centre line average of the workpiece and maximum depth of the profile as the outputs. The network was trained taking different neurons in the hidden layer as 10, 15 and 20. 15 neurons proved to be optimal. The weights obtained from the training were used for testing with 6 new patterns. Dimla [10] applied independent, descriptive inputs, viz. the three components of cutting force, three components of acceleration describing the vibration. Fusion of signals was emphasised. The results showed a success rate of 73-93% with a single layer perceptron, while the use of a multi layer perceptron scored an accuracy of 81-98%. The error obtained in the network was attributed to the noise in the data. The number of neurons in the hidden layer was fixed based on trial and error method to achieve the minimum error. Srikant [8] developed an ANN model using back propagation neural network for tool wear in wet machining. Better accuracy was reported compared to the built regression model (Eq.2). However, the model was built only for conventional lubrication method.

It is clear from the literature that the regression models and neural networks are employed for tool wear prediction as function of cutting conditions, tool geometry and work material. However, models applied to MQL are seldom found. Hence, there is a need for the development of prediction models as a function of lubricating conditions in MQL.

II. Mathematical Regression Model

A mathematical regression model has been built to estimate tool wear on line. AISI 1040 steel was machined using cemented carbide and HSS tools under constant cutting conditions on al 10 HP lathe to estimate several influencing measurable parameters like cutting forces, temperatures, surface roughness of machined samples, hardness of measured samples, etc. The cutting conditions adopted were:

Average cutting speed = 102 m/min
Feed range = 0.44 mm/rev
Depth of cut = 0.5 mm

Water miscible oil with carbon nano tube inclusion levels as 0.5%, 1%, 2%, 3%, 4% and 5% were used as coolant. Flow rate of the coolant was maintained as 100 ml/ hr. Basic properties of the fluids like kinematic viscosity, thermal conductivity, etc. were also measured and used to postulate the model.

In order to reduce the number of variables involved in the model, dimensional analysis is carried out and the following five non-dimensional Π-terms are deduced.

$$\Pi_1 = \upsilon * t_m / R_a^2 \quad (5)$$

$$\Pi_2 = (T * \upsilon * F_C) / (R_a^2 * k) \quad (6)$$

$$\Pi_3 = VB / R_a \quad (7)$$

$$\Pi_4 = (R_a^2 * H) / F_C$$

where, υ is kinematics viscosity of the fluids in m^2/s, t_m is the machining time in min, R_a is surface roughness in m, VB is tool flank wear in m, T is cutting temperature in ^0C, H is hardness of tool is MPa. Since relation between different machining parameters is inherently non-linear, a relationship was assumed as:

$$\Pi_3 = K_1 \, \Pi_1^a \, \Pi_2^b \, \Pi_4^c \quad (8)$$

The relation was converted into a linear relation by taking logarithms of Π terms as

$$\log \Pi_3 = \log K_1 + a * \log \Pi_1 + b * \log \Pi_2 + c * \log \Pi_4 \quad (9)$$

Multiple linear regression was carried out for the linearized terms using SPSS (a registered product of SPSS Inc., Chicago). Multiple linear regression postulates a functional dependence between the independent and dependent variables minimizing the modeling error. Experimental data obtained while using conventional cutting fluid, 0.5%, 1%, 2%, 3%, 4% and 5% CNT inclusion levels for HSS and cemented carbide tools was used to build the model, the remaining data was left for validation. A linear function was assumed between the logarithmic terms and the problem reduces to finding the coefficients a, b, c and K_1. In the present analysis, the above constants were found to be -0.284, 0.111, -0.903 and 139.31 (antilog of (2.144)) respectively. The formulated model may be expressed as:

$$VB = 139.31 \times (\upsilon^{-0.173}\ t_m^{-0.284}\ F_C^{1.014}\ H^{-0.903}\ T_C^{0.111} R_a^{-0.46}\ k^{-0.111}) \quad (10)$$

An average Regression coefficient of 0.91 was obtained.

Eq. 6 has been used to predict the value of tool wear from different parameters.

Analysis of Variance (ANOVA) is a powerful statistical technique often employed confirms the effect of several simultaneously applied factors on the response variable. A null hypothesis, postulating no dependence of the applied factors and response variables is considered and is checked for its validity. Degrees of Freedom (DF) and sum of the squares (SS) are computed for the considered data. F-statistic (variance ratio) is computed as the ratio of sums of squares denoting influence of factors and their interdependence. The computed value of variance ratio (F) is compared with the standard ANOVA table and the hypothesis is accepted or rejected at a particular (1% or 5%) confidence level. If the hypothesis is rejected at 1% confidence level, it also stands rejected at 5% confidence level [9].

In the present work, the degrees of freedom were found to be 3 and 122, F-statistic was obtained as 248.961 from SPSS. The tabulated critical value of F distribution for the obtained degrees of freedom at 1% significance level was 3.78. Hence the proposed null hypothesis advocating no dependence of tool wear on the taken parameters was rejected at 1% significance level. Hence the choice of parameters is justified.

III. Artificial Neural Networks

Tool wear monitoring in automated industries calls for monitoring systems that can replace human expertise and knowledge. Pioneering researchers realized that if computers are to replace humans then their design should resemble the brain. Artificial neural networks is a science that tries to imitate the mechanism of human brain in solving problems. Several types of artificial neural networks, based on particular computing abilities of the human brain are proposed. Choice of a particular neural network depends on the application [10].

Of the available artificial neural networks, back propagation network has gained importance due to the shortcomings of other available networks [11]. The network is a multi layer network that contains at least one hidden layer in addition to input and output layers.

The number of hidden layer neurons was kept as three and size of the network is fixed as 7-3-1, after testing for the error by trial and error. After fixing the network parameters, the network was trained using experimental data obtained while using 0, 0.5, 2, 4 and 5% CNT inclusions for HSS and cemented carbide tools to obtain stable weight structures. Using these weight structures, the network was tested for remaining data as input patterns.

IV. Validation of Proposed Models

The proposed models were validated by comparing the predicted results with the experimental results. Results from regression model and neural network model for HSS tool are compared with the experimental results (Figs. 1 & 2).

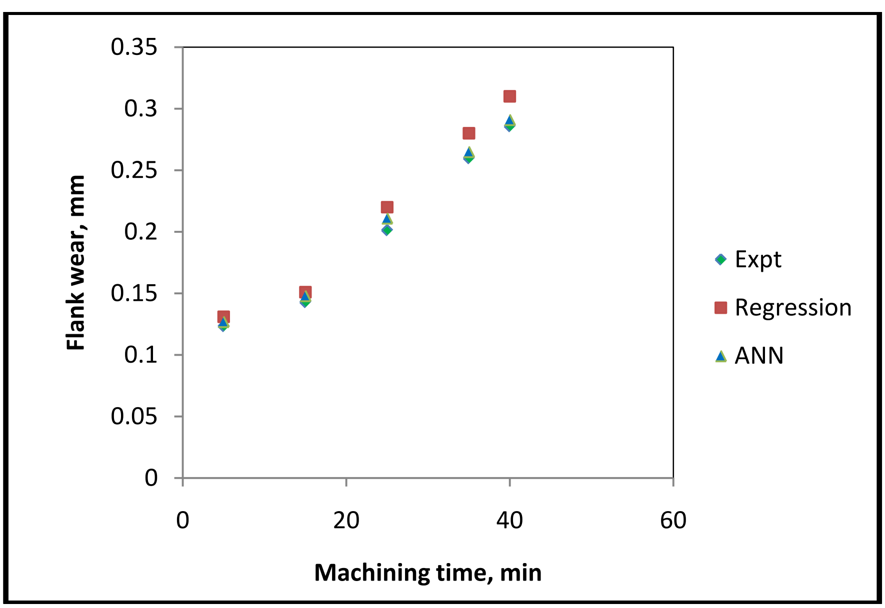


Fig. 1 : Comparison of predicted and experimental values while using HSS tool and cutting fluid with 1% CNT inclusion

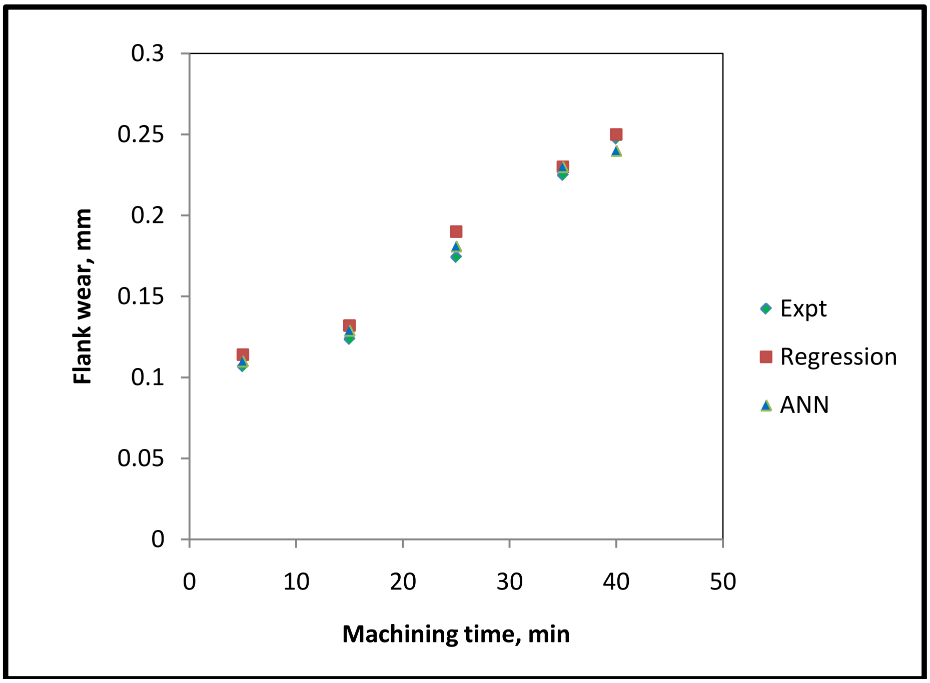


Fig. 2 : Comparison of predicted and experimental values while using HSS tool and cutting fluid with 3% CNT inclusion

Absolute values of percent errors obtained using regression and neural network models are presented in Table 1. It is observed that maximum error is 9.29% for regression model and 4.82% for neural network model.

Table 1 : Absolute error for prediction (HSS tool)

Machining time (min)	Error for 1 % CNT inclusion		Error for 3 % CNT inclusion	
	Regression	ANN	Regression	ANN
5	6.18	2.93	6.72	2.97
15	5.7	3.6	6.72	4.29
25	9.29	4.82	9.02	3.85
35	7.8	2.02	2.27	2.27
40	8.5	1.85	1.06	2.98

Results from regression model and neural network model for cemented carbide tool are compared with the experimental results (Figs. 3 & 4).

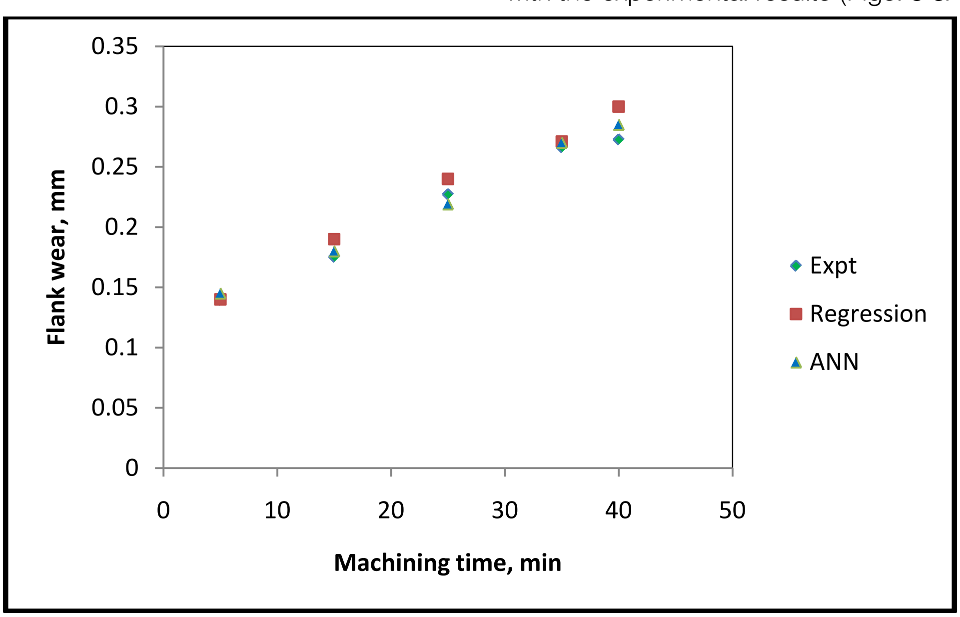


Fig. 3 : Comparison of predicted and experimental values while using cemented carbide tool and cutting fluid with 1% CNT inclusion

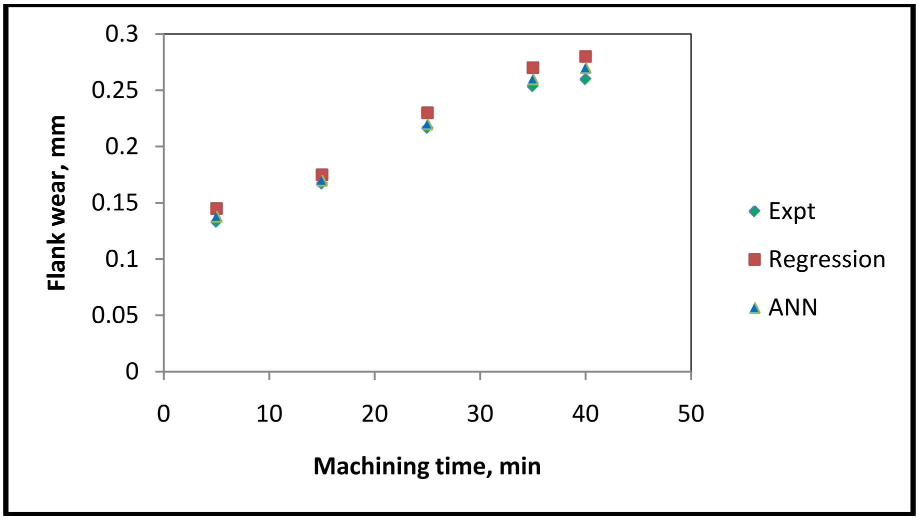


Fig. 4 : Comparison of predicted and experimental values while using cemented carbide tool and cutting fluid with 3% CNT inclusion

Absolute values of percent errors obtained using regression and neural network models are presented in Table 2. It is observed that maximum error is 9.29% for regression model and 4.82% for neural network model.

Table 2 : Absolute error for prediction (Cemented carbide tool)

Machining time (min)	Error for 1 % CNT inclusion		Error for 3 % CNT inclusion	
	Regression	ANN	Regression	ANN
5	0.28	3.86	9.05	3.79
15	8.37	2.67	4.80	1.81
25	5.6	3.64	6.26	1.64
35	1.79	1.41	6.48	2.54
40	9.81	4.5	7.8	3.95

Comparison of predicted tool wear with experimental results in all the tested cases indicate that the error is less than 10% in the prediction of tool wear using regression model and 5% for neural network model, validating both the models (Tables 1 & 2). Higher error in regression model predictions is obtained since some of the factors that contribute to tool wear like condition of the machine tool, inconsistencies in workpiece-tool compositions, etc. were not taken into account and this affects the regression model.

However, since neural network was trained with the experimental data and the influence of all the factors is inherently present in the data, the model is devoid of above limitations. No generalization of the data is done in neural networks, as in case of regression model for finding best-fit curve. Neural network maps the inputs to the outputs in multi-dimensions and takes care of non-linearity present in the case of study leading to more accurate predictions.

V. Conclusions

Tool wear prediction models were developed using mathematical regression and neural network. Experimental data of measured tool flank wear was used to develop the models. The models were used to predict tool wear for HSS and cemented carbide tools while using cutting fluids of different CNT content. Predicted tool wear values were compared with the experimental results to validate the developed models. Proposed regression and neural network models to predict tool wear based on several measurable parameters give the values of tool wear within acceptable limits. ANOVA justifies the parameters considered in the model. Neural network predicts tool wear with higher accuracy.

References Références Referencias

1. Milton C. Shaw, *"Metal Cutting Principles"*, 2nd Edition, Oxford University Press, USA, 2004.
2. Jerry P. Byers, *"Metalworking Fluids"*, 1st Edition, CRC, USA, 1994.
3. Y. Koren, *"Flank Wear Model of Cutting Tools using Control Theory"*, Trans. ASME Journal of Engineering for Industry, 100 (1978) 103-109.
4. Y. Koren, and E. Lenz, *"Mathematical Model for the Flank Wear while Turning Steel with Carbide Cutting Tools"*, Proc. CIRP seminar on Manufacturing Systems, Ljubljana, 1(2) (1972) 127-137.
5. D.N. Rao, *"Investigations into Tool-Wear Monitoring in Turning"*, Ph.D-thesis, IIT, Delhi, India, 1991.
6. X. Luo, K. Cheng, R. Holt and X. Liu, *"Modeling Flank Wear of Carbide Tool Insert in Metal Cutting"*, Wear, 259 (7-12) (2005) 1235-1240.
7. Ozel T, Karpat Y, *"Predictive Modeling of Surface Roughness and Tool Wear in Hard Turning using Regression and Neural Networks"*, International Journal of Machine Tools and Manufacture, 45 (2005)467–479.

8. R.R.Srikant, "Experimental investigations on the influence of emulsifier content in cutting fluids on machining performance and occupational environment", Ph.D-thesis, Andhra University, Visakhapatnam, India, 2008.
9. S. Purushothaman and Y.G. Srinivasa, *"A Back-Propagation Algorithm applied to Tool Wear Monitoring"*, Int. Journal of Machine Tools and Manufacture, 34 (5), 625-631, 1994.
10. Dimla E. Dimla, Sr, *"Application of Perceptron Neural Networks to Tool-State Classification in a Metal-Turning Operation"*, Engineering Applications of Artificial Intelligence, 12, 471-477, 1999.
11. Kishor S. Trivedi, *"Probability and Statistics with Reliability, Queuing and Computer Science Applications"*, 2nd Edition, John Wiley and Sons Ltd., Chichester, UK, 2001.
12. James.A. Freeman and David.M. Skapura, *"Neural Networks Algorithms, and Programming Techniques"*, Addison-Wesley, 1999.
13. N.K. Bose and P. Liang, *"Neural Networks Fundamentals with Graphs, Algorithms and Applications"*, Tata Mc. Grawhill Publishing Co. Ltd., 1998.

Global Journal of Research In Engineering
Automotive Engineering
Volume 11 Issue 5 Version 1.0 August 2011
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 Print ISSN: 0975-5861

Laboratory-Scale Bioremediation Experiments on Diesel and Polycyclic Aromatic Hydrocarbons Contaminated Soils

By Seyed Mostafa khezri, Seyed Hamidreza Fatemi, Saber Hasanlou

Islamic Azad University, Tehran, Iran.

Abstract - Laboratory investigations were performed to estimate the potential of bioslurry for bioremediation of PAHs and TPH-contaminated soil of Azimabad region in the south of Tehran refinery plant. The soil slurry-Sequencing Batch Reactor (SS-SBR) consisted of covered 8L Plexiglas vessel with a working volume of 6L. The reactor was equipped with a 400 rpm speed mixer. Oxygen was supplied through a fine-bubble diffuser at the bottom. A granular activated carbon trap as used to collect volatile organics in effluent air, fill period was relatively instantaneous, and Draw period lasted approximately 1 minute so the recent period comprised essentially the entire cycle time. In draw period a fraction of slurry (10%) was removed from period a fraction of slurry (10%) was removed from the SS-SBR weekly and it replaced with untreated slurry. This volumetric replacement volume of slurry (the recycle fraction) remained in the reactor to provide acclimated microorganism for the next batch of untreated slurry.

The soil used in slurry studies was poorly graded sand with clay (SP-SC) which contaminated with approximately 67500 mg/kg TPH and 500mg/kg PAHS and passed through a sieve with an opening diameter of 0.5mm tap water was added to produce solids concentration of 10% (0.1kg dry soil/l slurry). Ammonias nitrate and phosphate were added to provide a C: N: P ratio of approximately 60:2:1 process performance .The TPH concentrations were determined by Gas chromatography with Flame Ionization Detector (GC-FID) after ultrasonic extraction the PAHS concentrations were determined with both of High performance liquid chromatography (HPLC) an GC-FID after silica-gel clean up. The results have shown high overall removal efficiency for TPH close to 96%. whereas PAHs were not detected at the end of each cycles.

Keywords : *Bioremadiation,PAHs,TPH,SS-SBR.*

GJRE-C Classification : *FOR Code: 030301, 090401*

LABORATORY-SCALE BIOREMEDIATION EXPERIMENTS ON DIESEL AND POLYCYCLIC AROMATIC HYDROCARBONS CONTAMINATED SOILS

Strictly as per the compliance and regulations of:

Laboratory-Scale Bioremediation Experiments on Diesel and Polycyclic Aromatic Hydrocarbons Contaminated Soils

Seyed Mostafa khezri[α], Seyed Hamidreza Fatemi[Ω], Saber Hasanlou[β]

Abstract - Laboratory investigations were performed to estimate the potential of bioslurry for bioremediation of PAHs and TPH-contaminated soil of Azimabad region in the south of Tehran refinery plant.

The soil slurry-Sequencing Batch Reactor (SS-SBR) consisted of covered 8L Plexiglas vessel with a working volume of 6L. The reactor was equipped with a 400 rpm speed mixer. Oxygen was supplied through a fine-bubble diffuser at the bottom. A granular activated carbon trap as used to collect volatile organics in effluent air, fill period was relatively instantaneous, and Draw period lasted approximately 1 minute so the recent period comprised essentially the entire cycle time. In draw period a fraction of slurry (10%) was removed from period a fraction of slurry (10%) was removed from the SS-SBR weekly and it replaced with untreated slurry. This volumetric replacement volume of slurry (the recycle fraction) remained in the reactor to provide acclimated microorganism for the next batch of untreated slurry.

The soil used in slurry studies was poorly graded sand with clay (SP-SC) which contaminated with approximately 67500 mg/kg TPH and 500mg/kg PAHS and passed through a sieve with an opening diameter of 0.5mm tap water was added to produce solids concentration of 10% (0.1kg dry soil/l slurry). Ammonias nitrate and phosphate were added to provide a C: N: P ratio of approximately 60:2:1 process performance. The TPH concentrations were determined by Gas chromatography with Flame Ionization Detector (GC-FID) after ultrasonic extraction the PAHS concentrations were determined with both of High performance liquid chromatography (HPLC) an GC-FID after silica-gel clean up. The results have shown high overall removal efficiency for TPH close to 96%. whereas PAHs were not detected at the end of each cycles.

Keywords : Bioremadiation, PAHs, TPH, SS-SBR

I. Introduction

Bioremediation of contaminated soils offers a number of advantages over conventional treatments on the basis of its environmental friendliness and low costs. The interest inthis technology has increased over the last few years (,USEPA 2001).

Slurry-phase bioremediation technology is applicable for treating soils and sludge contaminated with hazardous wastes and it is a cost-effective alternative to cumbersome and often less effective treatment methods such as solid phase remediation(VenkataMohan et al., 2004, in press; Boopathy, 2000; Rahman et al., 2003; Bento et al., 2005; Sarma et al., 2006; Ramakrishna et al., 2006). The bioslurry treatment method has several advantages in that an optimal environment for degradation of the organic contaminants can be maintained with a high degree of reliability. Biological reactions can proceed at accelerated rates in a slurrysystem because of contact between contaminants and microorganisms, effective mixing and maintenance of high bacterial population, which enhance the degradation rate. (USEPA, 1993). Bioslurry reactors can be operated under aerobic or anaerobic or anoxic condi-tions(Zappi et al., 1996). Reduction in bioslurry reactors is initially postulated to be a consequence of the (potentially) limiting mass transfer rate i.e., from the soil to the aqueous phase, as it is assumed that microflora could only utilize substrates dissolved in aqueous phase.

Petroleum products such as diesel fuel, heavy oil, gasoline,fuel residues, and mineral oil are common soil contaminants. remediation of oil-contaminated soils to eliminate oily odors and oil .Im on runo. water and in groundwater is required.

The biodegradation of oils in a slurry-phase bioreactor(SPB) has a higher degradation rate than other biological treatment methods (US EPA, 1990; Puskas et al., 1995). Various modes of SPB operation have been tested in laboratories and pilot-scale plants, and one of the most common and best performing modes involves a soil slurry–sequencing batch reactor (SS-SBR).

The fate of polycyclic aromatic hydrocarbons (PAHs) in nature is of great environmental concern due to their toxic,mutagenic and carcinogenic properties (Haeseler et al.,1999). Their environmental mportance led the USEnvironmental Protection Agency (US-EPA) to identify 16 unsubstituted PAHs as priority pollutants, 8 of which are possible human carcinogens (Menzi et al., 1992). The potential use of microorganisms to clean up contaminated soil, sediments and water can provide efficient, inexpensive and environmentally safe cleanup of the waste material (Bishop, 1998).

In this study, we adopted a different method for enhancing the biodegradation of oil: we transferred the oils from the fine soil and increased contact between the

Author α : Asistant professor,Department of Environment and Energy, Science and research Branch, Islamic Azad University, Tehran,Iran.
Author Ω : Department of Environment and Energy, Science and research Branch, Islamic Azad University,Tehran, Iran.
Author β : Depatment of Environment and Energy, Science and research Branch, Islamic Azad University, Tehran, Iran.

microorganisms and the oil.. The microorganisms must be separated from the soil so that both can be reused.

The use of a support medium bearing the microorganisms also permitted the separation of the microorganisms from the soil after purification.

This paper describes the treatment of a soil with TPH and PAH contamination in laboratory bio-slurry reactor and describe the ability of that to remove oil and polycyclic aromatic hydrocarbons.

II. Soil Samples

The soil used in slurry studies was poorly graded sand with clay (SP-SC) which contaminated with approximately 67500 mg/kg TPH and 500mg/kg PAHS and passed through a sieve with an opening diameter of 0.5mm (Table 1)

III. Bioreactor

The study was carried out in the thermostated chamber (at21±0.3 ◦C) using a 8 l pyrex-made reactor with a 17.1 cm diameter and 47.0 cm height (Fig. 1), upper closed with a stainless steel flange to ensure the seal. The reactor operating level was set at 41.0 cm (leaving 6 cm of freeboard); thus the reactor working volume was 6 l. The reactor was equipped with a DO probe (cell OX325, WTW), a pH probe (Mettler Toledo) and a magnetic stirrer with a variable speed impeller, working at 400 rpm and placed in the flange central position. Oxygen was supplied by an air flow of 50 N l h−1 and distributed through a fine bubble diffuser at the bottom of the reactor. The air flow was forced to pass through a humidifier

Before entering the reactor, in order to minimize evaporation.Off gases firstly were piped to an air-cooled condenser andthen collected to an amberlite resin trap (XAD2 Supelco) to catch volatile organic compounds. Peristaltic pumps (Cellai 503U) were used for fill and draw operations.

IV. The Feed Slurry

Before using, the soil was passed through a 0.5mm sieve. The sieved fraction was partially air-dried and was stored at 4°C to maintain biological activity. Prior to using in bioslurry experiments, the samples were spiked with a known concentration of PAHs including Naphthalene, Phenanthrene and Pyrene (750 mg/kg) dissolved in dichloromethane. Tap water was added to produce a solids concentration of 10% (0.1 kg dry soil/L slurry). The Mineral Salt Medium (MSM) provide a C:N:P ratio of approximately 60:2:1 by adding ammonia, nitrate and phosphate as NH_4Cl, KNO_3, K_2HPO_4. Sodium sulphate (Na_2SO_4) and Magnesium sulphate heptahydrate ($MgSO_4.7H_2O$) were added with 2000 mg/L and 200 mg/L concentrations respectively. Since the samples were collected from an aged contaminated site, the endogenous microorganisms were supposed to degrade contaminants and therefore no adapted microorganism addition (bioaugmentation) was performed.

V. Experimental Design

6 L of prepared slurry was fed to reactor through the feed reservoir by gravity. The reactor was operated in sequencing batch mode. Fill period was relatively instantaneous, and Draw period lasted approximately 1 minute so the React period comprised essentially the entire cycle time. In draw period a fraction of slurry (10%) was removed from the SS-SBR weekly and it replaced with untreated slurry. This volumetric replacement strategy provided a 14 days solid retention time (SRT) and 70 days hydraulic retention time (HRT). A certain volume of slurry (the recycle fraction) remained in the reactor to provide acclimated microorganism for the next batch of untreated slurry.

VI. Analyses of Contaminants

a) *TPH analysis*

At every sampling event, the soil slurry samples were collected from all the reactors for the total petroleum hydrocarbon (TPH) analysis. Diesel fuel components were extracted with dichloromethane and analyzed by gas chromatography as follows. Fifty ml of dichloromethane was mixed with 25 ml ofsoil slurry sample in an airtight vial. The slurry–solvent mixture was mixed for 10 min with a wrist-action shaker to partition the diesel fuel components to the solvent phase. A 10 ml portion of the solvent was then transferred into a clean glass-barrel syringe. The solvent was filtered through a 0.5 mm TeNon membrane filter (Millipore Millex-SR 0:5 _m /lter unit; Bedford, MA) to remove particulates and through a sodium sulfate cartridge to remove water. Finally, a 2-ml sample of the filtrate was collected for analysis.

A gas chromatograph (GC) (Hewlett-Packard model 5890 T gas chromatograph with autosampler model 7673; Palo Alto, CA) with a capillary column (Supelco PTE-5TM, 30 m, 0:32 mm diameter, 0.25-_m /lm thickness; Bellefont, PA) and a Name ionization detector was used to detect and quantify the TPH. The GC was standardized using standards of refined No. 2 diesel fuel. The GC was operated with the helium carrier gas Now rate at 19.0 cm/s, column inlet pressure at 5.7 psi, inlet temperature at 300◦C, and an oven temperature program of40 ◦C (held 13 min) to 260◦C (held 10 min) at 8◦C/min. The total area counts from TPH analyses were used to calculate the percent degradation of TPH under each condition compared to corresponding time zero samples under each condition.

b) *Pah Analysis And Clean-Up Of The Extracts*

The extracts in all cases, were concentrated to 2–3 ml using a rotary evaporator and then to 1ml under a stream of nitrogen.

The extracts were passed through a mixed silica column to remove co-extractive substances. The column was packed at the bottom with cotton wool and then filled with 15 g of activated silica. 1 cm ofsodium rinsed with sulfate was added at the top of the column, the column was 30 ml of DCM and 30 ml of n-hexane.

VII. Results and Discussion

Slurry-phase biodegradation experiments were performed to investigate the remediation of PAHand TPH contaminated soil.

The SS-SBR was operated with a 14days cycle. Hydraulic retention time of 60 days was achieved by replacing 900 mL of the slurry volume every two weeks. TPH concentration at the end of each cycle is shown in Figure 1. TPH concentrations were reduced from 67.5 g/kg in the feed slurry to 2.7g/kg after treatment in the SS-SBR. This represents a removal efficiency of 95% (Fig1). Rates of TPH removal in SS-SBR showed a considerable decrease at first two weeks of operation

Also Fig. 2 shows the decrease in time removal efficienty of TPH in slurry-phase bioreactor treatments with 60 days HRT of the SBR.

But the concentration of pahs in the external sample could not be detected because it was very low.

VIII. Conclusion

The analyzes show that SS-SBR have a good ability for removing the petroleum and PAHs contaminated Soil.

In this process at the end of 60 days HRT the concentration of TPH is decreased from 67500 $mg/kgdrysoil$ to 3003 $mg/kgdrysoil$ that have removal efficiency of 96%

Also the analyze of low concentration of PAHs with Clean-up of the extracts can not practicable.

Table 1 : Soil content

Soil constituent	Measured value
Solids concentration (%w/v)	10
Slurry diesel fuel (mg/kg)	67500
Naphthalene concentration (mg/kg)	250
Pyrene concentration (mg/kg)	250
pH	7.6
CFU (107/g soil)	9

References Références Referencias

1. Hinchee and Olfenbuttel, 1991 R.E. Hinchee and R.F. Olfenbuttel, On-site bioreclamation: processes for xenobiotic and hydrocarbon treatment
2. Freeman and Harris, 1995. H.M. Freeman and E.F. Harris , Composting of contaminated soil ... In: B.C. Alleman and A. Leeson, Editors
3. Bioremediation of oil-contaminated desert soil: The Kuwaiti experience M. T. Balba, R. Al-Daher, N. Al-AwadhiH. Chino and H Tsuj
4. Cerniglia, C.E., 1992. Biodegradation of polycyclic aromatic hydrocarbons. Biodegradation 3, 351–368
5. Bishop, D.F., 1998. Perspective on remediation and natural recovery of contaminated sediments. In: United States Environmental ProtectionAgency National Conference on Management and Treatment of Contaminated Sediments, EPA/ 625/R-98/001, 27–36.
6. Bispo, A., Jourdain, M.J., Jauzein, M. , 1999. Toxicity and genotoxicity of industrial soils polluted by polycyclic aromatic hydrocarbons (PAHs).Organic Geochemistry 30, 947–952
7. Cassidy D. P. and Irvine R. L. (2000b) The effect of operating conditions on the biodegradation of diesel fuel in soil slurry-SBRs. Water Science and Technology (inpress).
8. U.S. Environmental Protection Agency (USEPA), EPA's Contaminated Sediment Management Strategy" EPA-823-F-98-004, April, 1998
9. S.E. Herbes, Partitioning of polycyclic aromatic hydrocarbons between dissolved and particulate phases in natural waters, Water Res.11 (1977) 493–496.

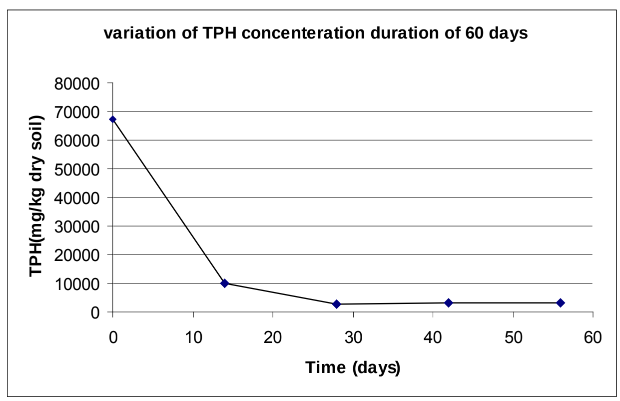


Figure 1 : *Variation of TPH concentration duration of 60 days*

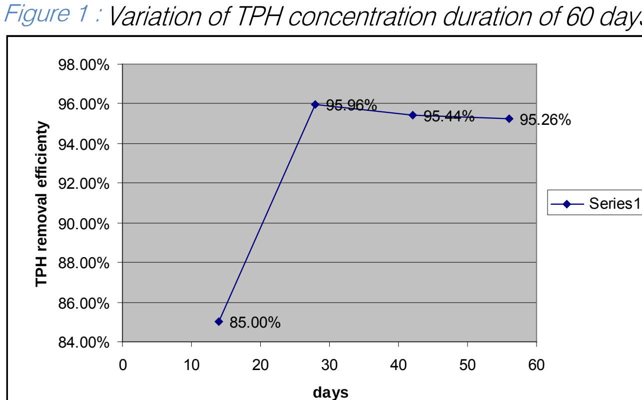


Figure 2 : *TPH removal efficiency during 90 days HRT*

This page is intentionally left blank

Global Journal of Research In Engineering
Automotive Engineering
Volume 11 Issue 5 Version 1.0 August 2011
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 Print ISSN: 0975-5861

Global Social and Economic Impact on The use of Biofuels and Recomendations for Sustainability

By Luis Barrera Aguilar, Héctor Montiel Campos, Ignacio Ramirez Leyva, Horacio Lima Gutierrez, Ricardo Sanchez Esquivel

Popular and Autonomous University of Puebla State (UPAEP) and Polytechnic University of Tlaxcala State (UPT).

Abstract - Biofuels currently represent a potential source of renewable energy. As well as that could lead to major new markets for farmers. However, only some of the current biofuel programs are feasible, and most involve high social costs and environmental ironically. The economic, environmental and social impacts of biofuels are widely debated and needs to be carefully assessed before extending public support to programs of biofuels on a large scale.The country strategy on biofuels should be based on a thorough assessment of these opportunities and costs in the medium and long term. One factor to consider is that oil reserves will run out, experts say, in fifty years. This article presents the social and economic impact of biofuel production in industrialized countries and developing countries that are or could become, efficient producers in export markets and profitable new.

Keywords : *Biofuels, biomass, renewable energy, fossil fuels.*

GJRE-B Classification : *FOR Code: 090201*

GLOBAL SOCIAL AND ECONOMIC IMPACT ON THE USE OF BIOFUELS AND RECOMENDATIONS FOR SUSTAINABILITY

Strictly as per the compliance and regulations of:

Global Social and Economic Impact on The use of Biofuels and Recomendations for Sustainability

Luis Barrera Aguilar[α], Héctor Montiel Campos[Ω], Ignacio Ramirez Leyva[β], Horacio Lima Gutierrez[Ψ], Ricardo Sanchez Esquivel[¥], Fabiola Serna Hernandez[§]

Abstract - Biofuels currently represent a potential source of renewable energy. As well as that could lead to major new markets for farmers. However, only some of the current biofuel programs are feasible, and most involve high social costs and environmental ironically. The economic, environmental and social impacts of biofuels are widely debated and needs to be carefully assessed before extending public support to programs of biofuels on a large scale.The country strategy on biofuels should be based on a thorough assessment of these opportunities and costs in the medium and long term. One factor to consider is that oil reserves will run out, experts say, in fifty years. This article presents the social and economic impact of biofuel production in industrialized countries and developing countries that are or could become, efficient producers in export markets and profitable new.

Keywords : Biofuels, biomass, renewable energy, fossil fuels.

I. Introduction

Biofuel is the term which is called to any type of fuel derived from biomass, refers to any organic matter of recent origin that has been derived from animals and plants as a result of photosynthetic conversion process, the biomass energy derived from plant and animal material such as wood from forests, residues from agricultural and forestry processes, industrial waste, human or animal (Hernández and Hernández, 2008).

Author α: Polytechnic University of Tlaxcala State (UPT) - Research Professor Industrial Engineerig Faculty. Av Universidad Politecnica No. 1, San Pedro Xalcatzinco, Tepeyanco, Tlax. C.P. 90199), E-mail : luis.barrera01@upaep.edu.mx, Tel.: +52-222-379 9837.

Author Ω : Popular and Autonomous University of Puebla State (UPAEP). Postgraduate Interdisciplinary Center (CIP). 21 Sur 1103 Col. Santiago, 72160. Puebla, México. E-mail : hector.montiel@upaep.mx , Tel. : +52-222-229 9400 Ext. 7783.

Author β: Polytechnic University of Tlaxcala State (UPT) - Research Professor Industrial Engineerig Faculty. Av Universidad Politecnica No. 1, San Pedro Xalcatzinco, Tepeyanco, Tlax. C.P. 90199), E-mail : ignazioramirez@yahoo.com.mx, Tel.:+52-222-125 7292.

Author Ψ : Polytechnic University of Tlaxcala State (UPT)- Research Professor Industrial Engineerig Faculty. Av Universidad Politecnica No. 1, San Pedro Xalcatzinco, Tepeyanco, Tlax. C.P. 90199), E-mail : horacio.lima@uptlax.edu.mx , Tel.: +52-246-1300 Ext. 2003.

Author ¥: Polytechnic University of Tlaxcala State (UPT) - Research Professor Industrial Engineerig Faculty. Av Universidad Politecnica No. 1, San Pedro Xalcatzinco, Tepeyanco, Tlax. C.P. 90199), E-mail : ingesolar@hotmail.com, Tel.: +52-246-1300 (author).

Author §: Popular and Autonomous University of Puebla State (UPAEP). Student of Doctorate in Strategic Planning and Management Technology. 21 Sur 1103 Col. Santiago, 72160. Puebla, Mexico. E-mail : fabiola.serna@upaep.edu.mx Tel. : +52-222-284 7923.

Biofuels currently represent a potential source of renewable energy that could also generate major new markets for agricultural producers (Hernández and Hernández, 2008, p.15). However, only some of the current biofuel programs are feasible, and most involve high social costs and environmental ironically. The economic, environmental and social impacts of biofuels are widely debated and needs to be carefully assessed before extending public support to programs of biofuels on a large scale.

The fuels of biological origin can replace part of the traditional fossil fuel consumption, such as oil or coal. Applying agricultural techniques and strategies appropriate processing, biofuels can provide emissions savings of at least 50% compared to fossil fuels such as diesel or gasoline (Hernández and Hernández, 2008, p.17). In addition, biofuels are produced from agricultural crops, which are renewable sources of energy.

A disadvantage in the production of these fuels has been rising for example, food prices, increased competition for land and water, and deforestation. When using agricultural land for direct cultivation of biofuels, rather than use only the remains of other crops, has begun to produce an effect of competition between food production and biofuels, resulting in an increase in the price of the first (Hernández and Hernández, 2008).

A key step in maximizing opportunities and regional comparative advantages, is to follow the procedures for environmental impact assessment, which are key instruments for decision making. The main impacts are related to increases in demand for inputs, resources and energy, with the potential risks to water quality and habitat conservation (Stachett, Rodrígues, Aparecida, Buschinelli, and Ligo, 2007).

One advantage is related to environmental preservation, any effective path leading to a reduced consumption of nonrenewable energy collides with the same difficulty: the decrease of the gain or extraordinary profits, which would negate the essence of a free market. The free market "can" help innovate something to sell (eg biofuels) that will help "keep", however the actual act of environmental preservation kills profits (Recompensa, Días, Zabala, and Ramos, 2008).

The purpose of this paper is to show the advantages and disadvantages in the use of biofuels, based on research of different authors and the social and economic impact of biofuel production in industrialized countries and developing, which could reach to be efficient producers in new export markets and profitable. This article is distributed as follows: Section 2 considers the current situation in the social and economic impact of biofuel production in industrialized countries and developing countries; section 3 presents the methodology , Section 4 the results, with advantages and disadvantages of using biofuels in developed and developing, and finally in Section 5 the conclusion, which presents the potential benefits to using biofuels.

II. State of the Art

a) Current status of biofuels

The world is facing a massive global campaign, which aims to include in the fastest possible way different raw materials such as sugar cane, soybeans, corn, rapeseed, sugar beet, etc., The production of biofuels as perfect substitutes petroleum derivatives. The main justifications found for this phenomenon are based on global warming and environmental pollution. The 1st generation biofuel specific crops used as raw materials, the most widely publicized are biodiesel and bioethanol. The latter represents more than 90% of all biofuels used today in the world. In Brazil, Sweden and the United States there are 6 million vehicles on the road that can accept mixed ethanol / gasoline up to 85%. The processing steps are different depending on the source of carbon and the technologies used in 1st generation processes are simpler than those of the 2nd processes and their production and investment costs are lower (Chauvet and González, 2008).

Figure 1 shows schematically the main stages to produce ethanol from sucrose (cane, beet, etc.), Starch (corn, wheat, tubers, etc.) And lignocellulosic residues (straw, agricultural residues and industrial, bagasse, etc.). The characteristics of lignocellulose offers major technical challenges, which increases the

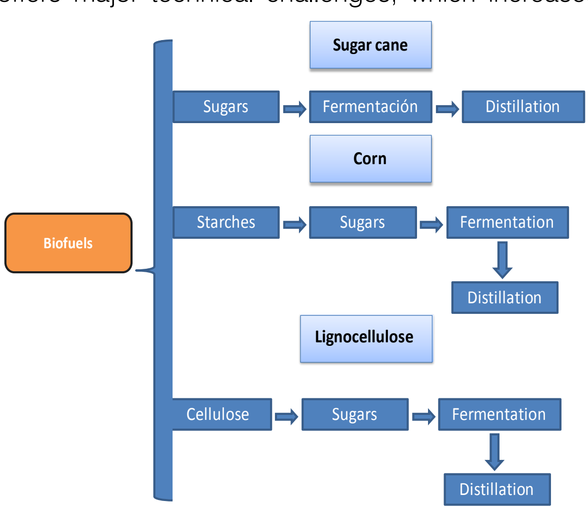


Figure 1 : Main stages to produce bioethanol

Global Journal of Researches in Engineering (B) Volume XI Issue V Version I August 2011

cost of production and investment technologies for the production of biofuels 2nd generation are under development in the world, and is expected to dip sensitive in both items in the medium and long term.

Table 1 shows the variation in the cost of bioethanol production 1st generation according to the carbon source and feedstock used (Chauvet and González, 2008).

source of carbon	Crops	Efficiency (l/ton of crops)	Efficiency (l/ha)	Production cost (USD/l	Country
Sucrose	Beet (juice)	100	7000	0.48	European Union
	Cane (juice)	70 - 85	6000	0.21	Brazil
		10	590	0.32	India
	Cane (molasses)	10	730	0.23-0.37	Mexico
	Sorghum	56-90	2500-4000		Sweden
Starch	Corn	400	3000	0.29-0.37	United States
	Wheat	340	2700	0.62	European Union
	Corn/Wheat	285		0.59	United States
Cellulose	Bagasse (cane)	55	3850	0.8	Chile

Table 1 : Main raw materials for ethanol

The differences between the energy that wants to get today's agriculture and energy contained in fossil fuels (oil, natural gas and coal) which represents 80% of the energy consumed in the world, the first is obtained as a result of photosynthesis : sun, water and nutrients that are purchased each year to crops, but fossil energy has the same origin but with the difference that the result of saving of photosynthesis produced over millions of years. Intention now is to replace all fossil fuel consumption (oil, natural gas and coal) using biofuels, which has a set of specific such as: a) high fossil energy consumption, b) the need to use large farms and concentration land c) intensive use of technologies and machines, d) large-scale environmental damage, e) high concentration of capital (Recompensa, Días, Zabala and Ramos, 2008).

The key to the economics of biodiesel production is in the raw materials used. In Colombia there have been several investigations at laboratory and pilot plant in order to obtain biodiesel from different raw materials such as palm oil, castor oil, frying oils and byproducts of the poultry industry. Castor oil belongs to the raw materials considered strategic for the production of biodiesel in the country. With regard to diesel engines, biodiesel, given the technical advantages, strategic and environmental features, is the best alternative to replace partially or totally to petroleum diesel fuel (Benavides, Benjumea and Pashova, 2007).

Biodiesel has achieved great interest as an alternative source of energy, as it has many attractive features: non-toxic, biodegradable, nonflammable, technically viable and economically competitive. In Medellin, Colombia was modeled and simulated a membrane bioreactor using an enzyme catalyst Candida Antarctica lipase for the production of biodiesel from palm oil and ethanol. The result was that the membrane reactor with immobilized enzymes is the best option for the production of biodiesel. Not only because it achieves high conversions, but also because it minimizes the residence time, it also shows the simultaneous separation of reactants and reaction products (Solano, Moncada, Cardona and Simón, 2008).

United States of America imports oil from different countries, so that its influence is global, both in the real economy and financial markets. From the supply side, oil-producing countries are in conflict zones and unstable, so it records a negative impact on international financial markets. The difficulty of projecting the price of oil, uncertainty in the estimation of future prices is one of the main points of the Agenda (international energy) despite the perception of high price insensitivity to bringing the complaint. On the other hand, specifically the United States seeks an increase in research investment in clean energy technologies and alternative fuel production (De Paula and Cristian, 2009).

It should be stressed that within this strategy, biofuels are meant to be part of the diversification of energy demand, such as with wind and solar. Given these energy programs, both U.S.A and European Union have increased their production volumes of biofuels each year. At the regional level Brazil is inserted internationally as a producer of biofuels, with a clear objective: to capture markets that require a demand for this type of energy above its level of production. Brazil is the world's largest producer of ethanol, from the use of sugar cane as feedstock, sharing leadership with the United States, which is produced from corn. Brazil, in addition to producing ethanol, biodiesel produces (De Paula and Cristian, 2009).

In Brazil, the Federal Government established that from 2008, the biodiesel should be added to diesel at 2% and from 2013 the percentage increased to 5%. For its part the European Union states that by 2010 all diesel fuel dispensed in Europe will contain 10% biodiesel (Aimaretti, Intilángo, Clementz and Yori, 2008). In the case of Argentina, are developing some points of the agricultural sector, from which it extracts the raw material for biodiesel: soybeans. To make feasible the alternative fuel business, it was necessary for soybean crops are grown in abundance in the country. In addition to this increase in yield for soybeans, another feature of the Argentine agricultural sector is that it has a highly competitive oil industry worldwide. In Argentina there are sustainable and unsustainable practices in agriculture. But the truth is that the challenges exist, and it should be noted that what is at stake is the strategic natural resource: the "soil" (De Paula and Cristian, 2009).

The bounded oil reserves and the need to reduce environmental pollution intensified the development of renewable fuels like biodiesel. In Argentina, the use of glycerol obtained as a byproduct of biodiesel production, is the key advantage as it provides added value to a low-cost feedstock, reducing the final cost of biodiesel produced, achieving an economic benefit (Aimaretti, Intilángo, Clementz and Yori, 2008).

In the case of Mexico, in 2006 began the construction of two ethanol plants in the state of Sinaloa. The argument for this policy is to dispose of corn production in the region to the niche market covering the states of California and Arizona in the United States, the two projects involve an investment of 85 million dollars and treated some 335 thousand tons of corn and sorghum. The benefits provided by the Sub-Objective direct income support to the account for the states of Sinaloa, Sonora, Tamaulipas, Chihuahua and Baja California, in 2004, with 62% of the tonnes supported, and in 2005 with 72%. Sinaloa has been the most benefited by concentrating 40% of subsidized tons nationwide in 2004, and 35.5% in 2005. The product has received more support is corn (Chauvet and González, 2008).

The politics of ethanol can have a significant impact on corn prices, causing costs to soar and may also increase the inefficiency of agricultural subsidies and vice versa. Production costs of ethanol from corn in the U.S. are very high. The gap between the intersection of the supply curve of ethanol and oil prices create large costs that can harm all the external benefits (Gorter and Just, 2010).

III. Methodology

Choose the topic to develop this article was based on the current problem: **the preservation of the environment**. Several points are factors in our research, given that biofuels currently represent a potential source of renewable energy, considering the volatility of international oil prices (energy resource of excellence) and that oil producing countries are in conflict zones and unstable , representing a negative impact on international financial markets (De Paula and Cristian, 2009).

The methodology used to develop research on the advantages and disadvantages in the use of biofuel, the social and economic impact in industrialized countries and developing, was performed based on descriptive research (Medina, 2007) and (Hernandez, Fernandez and Baptista, 2010, p.80), making an initial search process (data collection), collection (sampling), analysis of information (variables) and results in order to present an overview of the topic research.

The methodology undertaken for this research can be summarized in the following points:

1. Data capture

a. We performed an initial search procedure in scientific databases:
   Springer, Emerald, Wiley, Oxford Journals, World Scientific, Redalyc.

b. The search criteria were based on key words: biofuels, biomass, renewable energy, fossil fuels, etanol and diesel.

Global Journal of Researches in Engineering (B) Volume XI Issue V Version I August 2011

2. Sampling
a. In approximately 30 articles read were selected that had the most relevant and appropriate to the subject develops, and we choosing a total of 16 articles, which can be found in the references.
3. Information analysys
a. The information collected, carefully analyzed, following four main variables:

- Variable 1: Developing Countries.
- Variable 2: Industrialized countries.
- Variable 3: Benefits of the use of biofuels (point of view social and economic)
- Variable 4: Disadvantages of the use of biofuels (point of view social and economic)

4. Results
a. Based on the descriptive research and the variables used to analyze the information (research articles), provides the results of research that are the basis for the conclusions.

In Figure 2, you can see the applied methodology.

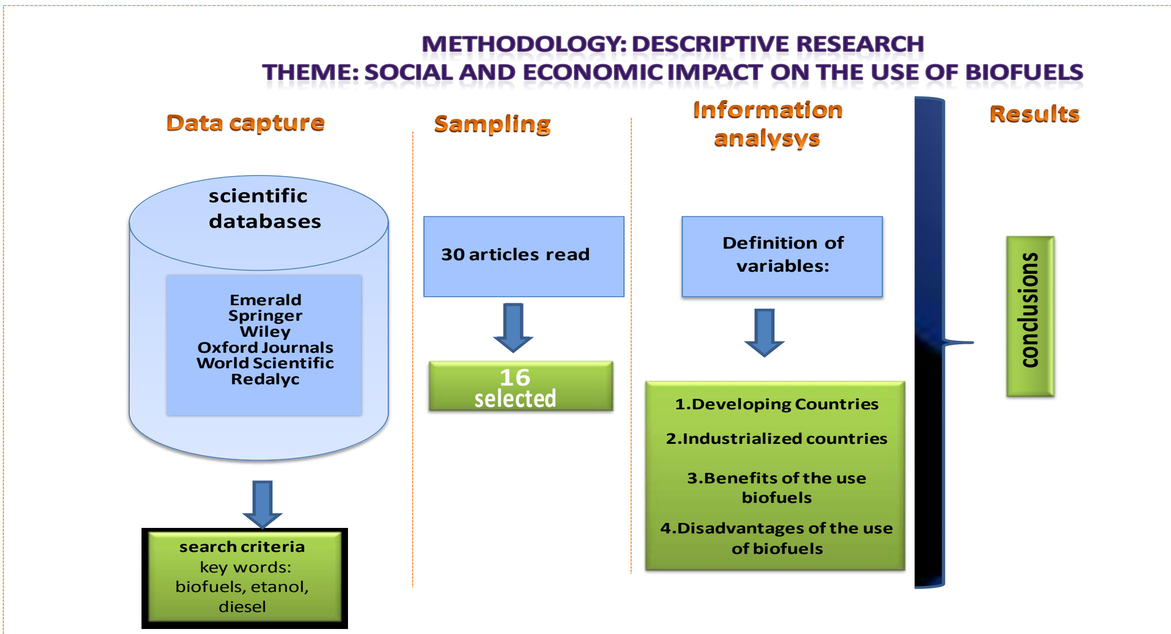


Figure 2 : Methodology

IV. Results

The results obtained in research on the advantages and disadvantages in the use of biofuel, the social and economic impact in industrialized countries and developing countries, are described in Table 2.

Variable 1: Developing countries	*Variable 2: Industria lized countries*	*Variable 3: Benefits of the use of biofuels (point of view social and economic)*	*Variable 4: Disadvantages of the use of biofuels (point of view social and economic).*
✓	✓	✓ The development of alternative energy, the progress in the investigation of second-generation biofuels and to promote greater use of biofuels, are just only a few points to follow in developed countries (De Paula and Cristian, 2009).	✓ Focus on production: the location of the sites are in countries that in recent years have demonstrated high legal uncertainty and unpredictability policy and regulatory (De Paula and Cristian, 2009).
Mexico		✓ In 2006, began the construction of two ethanol plants in the state of Sinaloa. The argument for this policy is to dispose of corn production in the region to the niche market that includes the states of California and Arizona, United States (Chauvet and González, 2008).	✓ The transportation costs of corn produced in Sinaloa to consumption centers in the south are high, no less incongruous than the volumes of corn destined for ethanol production when the country is importing, but more disturbing and scandalous is to subsidize the business of a few producers, such as **the social group is supporting an activity which is not profitable and also is exported** (Chauvet and González, 2008). ✓ Mexico as producer and exporter of oil, the renewable energy research is not their priorities (Chauvet and González, 2008).
Developed countries and particularly emerging economies China and India		✓ *Concentration and demand growth in developed countries and emerging economies* (De Paula and Cristian, 2009).	✓ *Financial speculation and uncertainty*, *The main reason for high prices is the growing perception in the markets, in the future the offer maybe will not be sufficient to satisfy demand*. (De Paula and Cristian, 2009).
	United States of America	✓ *Rationalize energy consumption in homes, buildings, businesses, cars and public transport so reduction contamination* (De Paula and Cristian, 2009).	✓ *Agricultural subsidies in the United States of America, the policy statement that ethanol reduces the tax costs, can still not be confirmed. But the inefficiency of production subsidies for corn and ethanol are still worrying, however ethanol production (and consumption) is constant, as determined by the government* (Gorter and Just, 2010). ✓ The increase in ethanol prices increases also the corn price , because it competes for the land with other crops (Gorter y Just, 2010).
	European Union	✓ *Direct their efforts to establish an energy diversification of oil supply.* ✓ Establish privileged partnerships with producer countries (Russia), transit (Algeria) and develop alternative energy (De Paula and Cristian, 2009).	
✓	✓	✓ Generation of second-generation biofuels obtained by biomass that can be obtained not necessaryly by inputs for food or compete with them (Chauvet and González, 2008).	✓ The reason that has stopped its application are the technical difficulties that they present , the estimated levels of investment and high production costs for obtain biofuels (Chauvet and González, 2008).
Brazil		✓ Capture of markets that require a demand for this type of energy above its level of production (De Paula and Cristian, 2009). ✓ The integration of technological development and pro-activity of all team members is crucial for the development of flexible fuel (De Souza, Sin, Nigro and Lima 2009). ✓ Production of biofuels in the world is profitable because of subsidies and incentives for renewable energy. In Brazil, the prices to be sustainable levels of profitability of ethanol production from sugar cane is profitable when a barrel of oil	✓ The high cost of castor oil and the relatively low level of technology, is still present in the production areas of Brazil and are the main obstacles to actually make feasible the production of biodiesel (Stachett, Rodrígues, Aparecida, Buschinelli, and Ligo, 2007).

		ranges from 45 to 50 USD (Chauvet and González, 2008). ✓ The local arrangements for the production offer the best options for promoting sustainable development and avoiding environmental degradation risks (Stachett, Rodrígues, Aparecida, Buschinelli, and Ligo, 2007). ✓ The socio-environmental impact and the intensification of production is reflected favorably on the expectations of farmer training, income generation, improved land value, and improving opportunities, training, and job quality indicators (Chauvet and González, 2008).	
✓	✓	✓ Participation of governments, some governments have provided incentives and financing to develop for new technologies with the aim of achieving a sustainable economy (Hazy, Torras and Ashley, 2008). ✓ *Tariff*, Biofuel production in industrialized countries has been developed under the protection of high tariffs, while subsidies granted to producers (Hernández and Hernández, 2008).	✓ Biofuel production has influenced the increase in food prices (corn, wheat and sugar cane), that probably to keep growing over the next decade. These increases not only include food used for fuel production but will also have expanded to meat and vegetables. (Sanhueza, 2009).
	Japan	✓ Being a buyer of Brazilian products but wants to ensure that the supply of the product will not be interrupted (Recompensa, Días, Zabala and Ramos, 2008).	✓ The free market prefer the renewable energy sources because they are easily controlled (Recompensa, Días, Zabala and Ramos, 2008). ✓ In countries where the rights over mineral resources are privately owned (such as in the United States of America and Canada), these resources can be controlled via property rights and that situation is a disadvantage for Japan, because for biofuels can be apply the same situation (Recompensa, Días, Zabala and Ramos, 2008). ✓ In the rest of the world, the minerals can be easily controlled through exclusive contracts with governments (Recompensa, Días, Zabala and Ramos, 2008).
Colombia		✓ The simulation of the production of biodiesel from palm oil using an immobilized lipase as biocatalyst (Candida Antarctica) in a membrane bioreactor, is the best option for biodiesel production (Solano, Moncada, Cardona and Simón, 2008).	
Argentina		✓ *The use of glycerol obtained as a byproduct of biodiesel production, is the key advantage as it provides added value to a low-cost in raw material, reducing so the final cost of biodiesel produced, achieving an economic benefit* (Aimaretti, Intilángo, Clementz and Yori, 2008). ✓ Improving fuel quality through the use of additives, significantly reduces the environmental pollution produced, helping to meet stringent environmental regulations that apply today (Aimaretti, Intilángo, Clementz and Yori, 2008).	

Table 2 : Results of the advantages and disadvantages of using biofuels.

IV. Conclusions

In the production of biofuels, if we take the example of ethanol and other biofuels in Brazil, this attempted solution to our energy problems are being controlled through ownership or lease of land to produce raw materials and /or the Intellectual property (proprietary processes of distillation, proprietary microbes that turn sugar substances, etc.), the point is that governments create more problems, no matter that biofuels provide a low energy return on investment, the depletion of fertile soils , pollution and energy, **what matters is that governments can do a lot of money** (Recompensa, Días, Zabala and Ramos, 2008).

In relation to environmental preservation any effective path leading to a reduced consumption of nonrenewable energy collides with the same difficulty: the decrease of the gain or extraordinary profits, which would negate the essence of free market (Recompensa, Días, Zabala and Ramos, 2008).

First generation biofuels *such as ethanol production is one of the more traditional industrial applications in all respects, the requirements of scale, costs and improving efficiency in fuel use almost inevitably point towards the use of transgenic crops, which further complicate the national debate.* ***The second-generation biofuels*** *are the benefits that can be obtained from biomass that is not appropriated for food supplies or compete with them, such as agricultural harvests, industrial and urban waste, so there is also rivals for the use of natural resources. Cost-effective production of ethanol obtained from lignocellulose via enzymatic hydrolysis would increase the variety and availability of basic material and, therefore, expand the production of biofuels without compromising food security and sovereignty* (Chauvet and González, 2008).

The trend is towards second generation biofuels, since the use of crops for biofuel does not replace the energy needs of low-cost oil achieved today and its derivatives. Hence the importance for a country like Mexico, at this time, to allocate resources for Research & Development for 2nd generation biofuels. For the July 24, 2007, the administration reported that "the federal government will not support projects and ethanol plants carrying corn as raw material, since it has the priority of this cereal are not distracted from their destinations in human food or animal nutrition " (Chauvet and González, 2008).

The management of strategic natural resource "soil" presents a challenge because there is no quantification of damages in the case of unsustainable practices (De Paula and Cristian, 2009).

Is important to link the sustainability standards for biofuels policies, the most logical approach would be to punish or compensate the use of ethanol. Concerns about land use for biofuels can be contracted with the overall theme of global climate change in general. Agriculture has considerable potential for the mitigation of greenhouse gases, especially in developing countries. The impact of biofuel policies in the development and adoption of new technology should be examined. Biofuel policies may be needed to ensure the market in order to exploit the benefits of learning "doing and using" dynamic benefits and innovation of new technologies (Gorter and Just, 2010).

The production of biofuels is part of a competitive strategy in the global market, mainly for developed countries like the United States. The problem created by the rising international food prices exacerbated a structural agricultural situation in Mexico, where he has abandoned the priority to have an auto policy in food supply and insufficient support investment in the field (Merino and Castañeda, 2008). Bioenergy generation is not the panacea for poverty in the Mexican countryside, nor would solve the problems of the country's economy in general. You can create a problem socioeconómicoambiental, not planned in a multidisciplinary production, use and exploitation (González, 2009).

a) Recommendations

For the use of biofuels actually be an advantage in the economic, social and environmental care, should take care of the following (Serna, F., Barrera, L.):

1. **Biofuels policy :** The success of biofuels depends on their use mandatory, tax facilities, subsidies provided by the State, pricing to consumers, the recognition of the rights of workers and the thousand and one ways develop from the rural communities and effective use of their land.
2. **Grants :** The production of biofuels in the world is profitable because of subsidies and incentives for renewable energy, but must ensure that these subsidies are allocated to the most vulnerable.
3. **Soil use :** The problem of land use represents the medium and long term environmental liabilities is hardly balanced with assets derived from the production of biofuels.
4. **Second generation biofuels :** They should turn the attention to second generation biofuels, the advantages is that they can be obtained from biomass that is not appropriated for food supplies or compete with them and protect this soil use.
5. **Research & Development :** Both developed and developing nations must pay attention to the benefits associated with research and development, adopt new technologies, resulting in improved environmental heritage and obtaining economic benefits in the development of biofuels.
6. **Profit vs. environmental benefits :** The ambition for the profits do not should exceed the benefits of environmental preservation. In relation to environmental preservation any effective path leading to a reduced consumption of nonrenewable energy collides with the same difficulty: the decrease of the gain or extraordinary profits.

References Références Referencias

1. Aimaretti, N., Intilángo, L., Clementz, A., Yori, C. (2008). Aprovechamiento de la glicerina obtenida durante la producción de biodiesel. *Revista Invenio*, *Redalyc,* 11(020), 137-144.
2. Benavides, A., Benjumea, P., Pashova, V. (2007). El biodiesel de aceite de higuerilla como combustible alternativo para motores diesel. *Revista Dyna, Redalyc,* 74(153), 141-150.
3. De Paula, G., Cristian, L. (2009). Inseguridad energética y gestión de recursos naturales estratégicos: análisis de la política de biocombustibles en Argentina en el contexto global. *Revista UNISCI Discussion*, *Redaly,* 1(20), 60-77.
4. De Souza, P., Sin, A., Nigro, F. and Lima, C. (2009). Exogenous Factors in the Development of Flexible Fuel Cars as a Local Dominant Technology. *Journal of Technology management* & *innovation,* 4(4), 110-119.
5. González, A. (2009). Producción de bioenergía en el norte de México: tan lejos y tan cerca... *Revista Frontera Norte, Redalyc,* 21(41), 177-183.
6. Gorter, G. and Just, D. (2010). The Social Costs and Benefits of Biofuels: The Intersection of Environmental, Energy and Agricultural Policy. *Applied Economic Perspectives and Polic,* 32(1), 4–32.
7. Hazy, J., Torras, M. and Ashley, A. (2008). Reconceptualizing value creation with limited resources. *Journal of Technology management* & *innovation*, 3(3), 45-54.
8. Hernández, M., y Hernández, J. (2008). Verdades y mitos de los biocombustibles. *Elementos 71* , 15-18.
9. Hernández, R., Fernández, C., y Baptista, L. (2010). Metodología de la investigación. México: Editorial McGraHill.
10. Chauvet, M. y González, R. (2008). Biocombustibles y cultivos biofarmacéuticos: ¿oportunidades o amenazas? *Revista El Cotidiano*, *Redalyc,* 23(147), 51-61.
11. Medina, C. (2007). Como plantear un problema de investigación y seleccionar un diseño de estudio apropiado. *Revista Archivos en medicina familiar, Redalyc*, 9(3), 127-132.
12. Merino, G. y Castañeda, Z. (2008). Biocombustibles, biotecnología y alimentos. Impactos sociales para México. *Revista Argumentos, Redalyc,* 21(57), 55-83.
13. Recompensa, L., Días, D., Zabala, A., y Ramos, P. (2008). Biocombustibles: ¿Una estrategia de desarrollo o de mercado lucrativo sostenible? *Polis, Universidad Bolivariana*, 021, 1-17.
14. Sanhueza, E. (2009). Agroetanol ¿un combustible ambientalmente amigable? *Revista Interciencia,* 34(2), 106-112.
15. Solano, P., Moncada, J., Cardona, C., Simón, O. (2008). Modelamiento y simulación de un biorreactor de membrana para obtención de biodiesel. *Revista Interciencia*, *Redalyc,* 44(151), 84.92.
16. Stachett, G., Rodrígues, I., Aparecida, I., Buschinelli, C., y Ligo, M. (2007). Socio-environmental al impact of biodiesel productionin Brazil. *Journal of Technology management* & *innovation* , 2(2), 46-66.

Global Journals Inc. (US) Guidelines Handbook 2011

www.GlobalJournals.org

FELLOW OF INTERNATIONAL CONGRESS OF RESEARCESH IN ENGINEERING (FICRE)

- 'FICRE' title will be awarded to the person/institution after approval of Editor-in-Chief and Editorial Board. The title 'FICRE' can be added to name in the following manner:
  e.g. **Dr. Andrew Knoll, Ph.D., FICRE**
- FICRE can submit two papers every year for publication without any charges. The paper will be sent to two peer reviewers. The paper will be published after the acceptance of peer reviewers and Editorial Board.
- **Free unlimited Web-space** will be allotted to 'FICRE'along with subDomain to contribute and partake in our activities.
- A **professional email address** will be allotted free with unlimited email space.
- FICRE will be authorized to receive e-Journals -GJRE for the Lifetime.
- FICRE will be exempted from the registration fees of Seminar/Symposium/Conference/Workshop conducted internationally of GJRE (FREE of Charge).
- FICRE will be Honorable Guest of any gathering held.

ASSOCIATE OF INTERNATIONAL CONGRESS OF RESEARCH IN ENGINEERING (AICRE)

- AICRE title will be awarded to the person/institution after approval of Editor-in-Chef and Editorial Board. The title 'AICRE' can be added to name in the following manner:
  eg. Dr. Thomas Knoll, Ph.D., AICRE
- AICRE can submit one paper every year fo r publication without any charges. The paper will be sent to two peer reviewers. The paper will be published after the acceptance of peer reviewers and Editorial Board.
- Free 2GB Web-space will be allotted to 'FICRE' along with sub Domain to contribute and participate in our activities.
- A professional email address will be allotted with free 1GB email space.
- AICRE will be authorized to receive e-Journal GJRE for lifetime.

ANNUAL MEMBER

- Annual Member will be authorized to receive e-Journal GJRE for one year (subscription for one year).
- The member will be allotted free 1 GB Web-space along with subDomain to contribute and participate in our activities.
- A professional email address will be allotted free 500 MB email space.

PAPER PUBLICATION

- The members can publish paper once. The paper will be sent to two-peer reviewer. The paper will be published after the acceptance of peer reviewers and Editorial Board.

Process of submission of Research Paper

The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

(II) Choose corresponding Journal.

(III) Click 'Submit Manuscript'. Fill required information and Upload the paper.

(B) If you are using Internet Explorer, then Direct Submission through Homepage is also available.

(C) If these two are not convenient, and then email the paper directly to dean@globaljournals.org.

Offline Submission: Author can send the typed form of paper by Post. However, online submission should be preferred.

MANUSCRIPT STYLE INSTRUCTION **(Must be strictly followed)**

Page Size: 8.27" X 11'"

- Left Margin: 0.65
- Right Margin: 0.65
- Top Margin: 0.75
- Bottom Margin: 0.75
- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, “Abstract” word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

You can use your own standard format also.
Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript’s Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

The Global Journals Inc. (US) welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals Inc. (US) is parental platform for Global Journal of Computer Science and Technology, Researches in Engineering, Medical Research, Science Frontier Research, Human Social Science, Management, and Business organization. The choice of specific field can be done otherwise as following in Abstracting and Indexing Page on this Website. As the all Global

Journals Inc. (US) are being abstracted and indexed (in process) by most of the reputed organizations. Topics of only narrow interest will not be accepted unless they have wider potential or consequences.

2. ETHICAL GUIDELINES

Authors should follow the ethical guidelines as mentioned below for publication of research paper and research activities.

Papers are accepted on strict understanding that the material in whole or in part has not been, nor is being, considered for publication elsewhere. If the paper once accepted by Global Journals Inc. (US) and Editorial Board, will become the copyright of the Global Journals Inc. (US).

Authorship: The authors and coauthors should have active contribution to conception design, analysis and interpretation of findings. They should critically review the contents and drafting of the paper. All should approve the final version of the paper before submission

The Global Journals Inc. (US) follows the definition of authorship set up by the Global Academy of Research and Development. According to the Global Academy of R&D authorship, criteria must be based on:

1) Substantial contributions to conception and acquisition of data, analysis and interpretation of the findings.

2) Drafting the paper and revising it critically regarding important academic content.

3) Final approval of the version of the paper to be published.

All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

Acknowledgements: Contributors to the research other than authors credited should be mentioned under acknowledgement. The specifications of the source of funding for the research if appropriate can be included. Suppliers of resources may be mentioned along with address.

Appeal of Decision: The Editorial Board's decision on publication of the paper is final and cannot be appealed elsewhere.

Permissions: It is the author's responsibility to have prior permission if all or parts of earlier published illustrations are used in this paper.

Please mention proper reference and appropriate acknowledgements wherever expected.

If all or parts of previously published illustrations are used, permission must be taken from the copyright holder concerned. It is the author's responsibility to take these in writing.

Approval for reproduction/modification of any information (including figures and tables) published elsewhere must be obtained by the authors/copyright holders before submission of the manuscript. Contributors (Authors) are responsible for any copyright fee involved.

3. SUBMISSION OF MANUSCRIPTS

Manuscripts should be uploaded via this online submission page. The online submission is most efficient method for submission of papers, as it enables rapid distribution of manuscripts and consequently speeds up the review procedure. It also enables authors to know the status of their own manuscripts by emailing us. Complete instructions for submitting a paper is available below.

Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5. STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

Color Charges: It is the rule of the Global Journals Inc. (US) for authors to pay the full cost for the reproduction of their color artwork. Hence, please note that, if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a color work agreement form before your paper can be published.

Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.

6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

6.1 Proof Corrections

The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

As changes to proofs are costly, we inquire that you only correct typesetting errors. All illustrations are retained by the publisher. Please note that the authors are responsible for all statements made in their work, including changes made by the copy editor.

6.2 Early View of Global Journals Inc. (US) (Publication Prior to Print)

The Global Journals Inc. (US) are enclosed by our publishing's Early View service. Early View articles are complete full-text articles sent in advance of their publication. Early View articles are absolute and final. They have been completely reviewed, revised and edited for publication, and the authors' final corrections have been incorporated. Because they are in final form, no changes can be made after sending them. The nature of Early View articles means that they do not yet have volume, issue or page numbers, so Early View articles cannot be cited in the conventional way.

6.3 Author Services

Online production tracking is available for your article through Author Services. Author Services enables authors to track their article - once it has been accepted - through the production process to publication online and in print. Authors can check the status of their articles online and choose to receive automated e-mails at key stages of production. The authors will receive an e-mail with a unique link that enables them to register and have their article automatically added to the system. Please ensure that a complete e-mail address is provided when submitting the manuscript.

6.4 Author Material Archive Policy

Please note that if not specifically requested, publisher will dispose off hardcopy & electronic information submitted, after the two months of publication. If you require the return of any information submitted, please inform the Editorial Board or dean as soon as possible.

6.5 Offprint and Extra Copies

A PDF offprint of the online-published article will be provided free of charge to the related author, and may be distributed according to the Publisher's terms and conditions. Additional paper offprint may be ordered by emailing us at: editor@globaljournals.org .

the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. **Pick a good study spot:** To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. **Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page

- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.
- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.

- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

Administration Rules Listed Before Submitting Your Research Paper to Global Journals Inc. (US)

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals Inc. (US).

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

INDEX

save our planet

Global Journal of Researches in Engineering

Visit us on the Web at www.GlobalJournals.org | www.ComputerResearch.org
or email us at helpdesk@globaljournals.org

ISSN 9755861