An Approach for Current Producing Through PWS Method to Separate H_2O_2 from Sea Water

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Abstract – Electrolysis is an electrochemical process in which electrical energy is the driving force of chemical reactions. Substances are decomposed by passing a current through them. Water is decomposed to hydrogen and oxygen. By thus we create the hydrogen peroxide by water electrolysis method. For the electrolysis process the electrical energy formed by the PWS method (piezoelectricity, wind mill and solar panel process) and stored in the battery. Then the hydrogen peroxide might mix with the ship fuel to get high efficiency than those now using methods.

Index Terms – Piezoelectricity, windmill, solar panel, battery, electrolysis, H_2O_2 with ship fuel.

1. INTRODUCTION

World is a store house of energy. We all know that energy can neither be created nor destroyed but can be transformed from one form to another. But we are wasting resources that can produce limitless energy. If we use that wasting resource energy, then it will be very useful to cure the energy problems. By using the concept of electrolysis hydrogen peroxide may produce and mix with the ship fuel. This mixable fuel might give more than five times of ordinary energy while compared with ordinary energy usage process.

1.1. Piezoelectricity

The piezoelectric effect is a direct transformation of mechanical energy into electrical energy. Piezoelectricity was discovered by Jacques Curie and Pierre Curie in 1880 [1, 2, 5]. They observed that certain crystals respond to pressure by separating electrical charges on opposing faces and named the phenomenon as piezoelectricity.

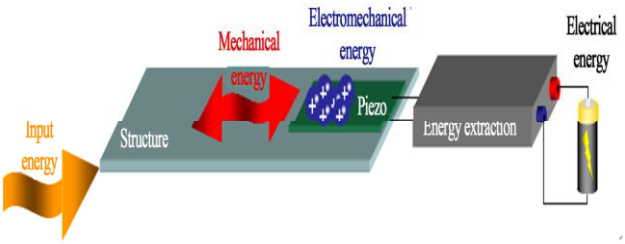


Figure 1: Process of piezoelectricity

In general, the applied external force is converted into mechanical energy in the host structure. Then, this energy is converted into electrical energy by the use of piezoelectric material, and is finally transferred into electrical form to a storage stage [3, 4]. Therefore, three basic processes are performed: conversion of the input energy (vibration) into mechanical energy (strain), electromechanical conversion using piezoelectric material, and electrical energy transfer as described in figure 1.

We may produce Reverse piezoelectric effect also by applying current to do the mechanical energy [6]. This process of piezoelectricity may implement in the flag system also.

2. Wind Energy

We can use the kinetic energy of the wind as work. In olden years humans are used this wind energy to pump the water and etc. Wind is caused due to two main factors:

(a) Due to air in motion.
(b) Due to the rotation of the earth with respect to atmosphere, and its motion around the sun [9].

We can also produce electrical energy by the means of wind energy. Wind energy which is an indirect source of solar energy conversion can be utilized to run windmill, which in turn drives a generator to produce electricity [7].

The wind mill generally consists of a turbine connected to large rotating blades. The blades rotate by incidental of wind which is fully depends on its speed that is velocity. Use of this would help in producing cheap power.

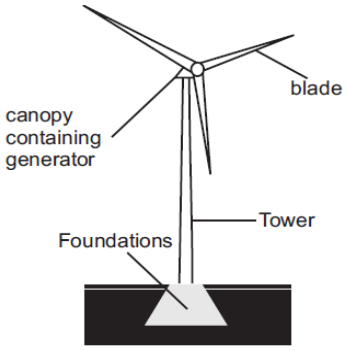


Figure 2: Windmill

The smallest turbines are used for applications such as battery charging for auxiliary power for boats or caravans or to power traffic warning signs [10][11].

3. Solar Energy

The sun is a large sphere of very hot gases [7]. Their energy being generated there by various kinds of nuclear fusion reactions. Sun gives us 1000 times more and above power than we need. Therefore, solar energy is a major source of power while compared with other type of energies. Even if we could tap one thousandth of solar power, that will satisfy our requirements. But so far it could not be developed on a large scale. Solar energy termed as when the energy which reaches the earth by produced and radiated by the sun. Energy is radiated by the sun, as electromagnetic waves. Solar energy, received in the form of electromagnetic radiation, can be converted directly or indirectly into other forms of energy, such as heat and electricity. That can be utilised by human being. Since the sun can radiate energy at constant rate for a few billion years, it may be regarded as an inexhaustible source of useful energy.

Some important applications of solar energy are

(I) Solar water heating, (ii) Heating and cooling of residential buildings, (iii) salt production by evaporation of sea water, (iv) Solar cookers, (v) Solar furnaces, (vi) Solar pumps for water pumping and (vii) Solar electric power generation.

From solar energy electricity can be produced with the help of photovoltaic or solar cells. The solar cells directly generate electricity by photovoltaic process [8]. When the photons from the sun's light is absorbed by special type of semi conducting material they create free electrons. These free electrons induce higher energy electrons to flow out of the semiconductor. The flow of higher energy electrons in the circuit constitutes the electric current [9].

3.1. Solar Electric Power Generation

The direct conversion of solar energy into electrical energy made by means of the photovoltaic effect. Where it converts the light energy into electrical energy. Energy conversion devices which is converts light into electricity due to photovoltaic effect called as solar cells. A single converter cell is called solar cell and combination of such cells called solar array.

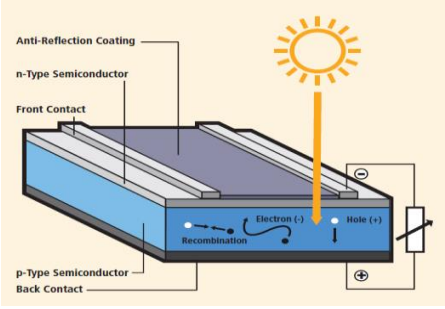


Figure 3: The action of PV cell

If we increase the solar array then we will get increase of electricity as output. PV (Photovoltaic) cells are made up of semiconductors that absorb the light and generate the electricity [9]. As photons are received free electrical charges are generated that can be collected on contacts applied to the surfaces of that semiconductor [8].

By thus we may apply a battery as a storage system. Whenever, the battery supplies the needful.

4. Battery

Figure 4: A battery model

From chemical reactions the electrical energy was produced in the battery. According to the chemicals we can differentiate its kinds. Here the concept is the two different chemicals with in a battery cell have different loads and are connected with a cathode electrode and other with anode electrode. When it connected to any instrument, the cathode electrode supplies a current of electrons that flow through the instrument and it is accepted by the anode electrode.

By thus the stored electrical energy on battery might be discharged. We may also changes it as charged as electrical energy stored one. While on discharging the anions moves together anode and the cations moves together cathode. This reaction can be almost completely reversed by supplying the electricity on electrodes then the battery can be recharged [12].

5. Hydrogen Peroxide

Hydrogen will not explode in a single state. Even a mixture of hydrogen with oxygen or air gives no reaction. But when these mixtures are ignited a fast exothermic reaction takes place. Combination of hydrogen as well as oxygen is nothing but Hydrogen peroxide. [19]Hydrogen peroxide was first prepared by L.J.Thenard in 1813 by the action of dilute acid on barium peroxide [20]. Traces of hydrogen peroxide are commonly found in atmosphere and certain plants. By the laboratory preparation the calculated quantity of sodium peroxide is added in small proportions to a 20 ice cold solution of sulphuric acid.[19]

$$Na_2o_2 + H_2So_4 \rightarrow Na_2So_4 + H_2o_2 \quad (1)$$

Pure H_2So_4 is obtained by reacting Bao_2 with an acid

$$BaO_2 + H_2So_4 \rightarrow Ba_3(PO_4)_2 + 3\,H_2O_2 \quad (2)$$

The physical properties are colorless, odorless, syrupy liquid in the anhydrous state. And it is mixable with water, alcohol and ether in all proportions. The chemical properties are unstable and decompose on standing. When we heat it water and oxygen were formed [16][17].

$$2\,H_2O_2 \rightarrow 2\,H_2o + O_2 \quad (3)$$

Through the electrolysis process we may obtain the hydrogen and oxygen gases easily by breaking the bonds between them. In the electrochemical process the cell is filled with pure water and has two electrodes connected with an external power supply. At a certain voltage, which is called critical voltage, between both electrodes, the electrodes start to produce hydrogen gas at the negatively biased electrode and oxygen gas at the positively biased electrode.

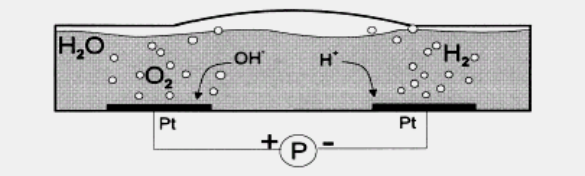


Figure 5: Electrolysis process

$$H2O\ (l) \leftrightarrow H+\ (aq) + OH-\ (aq) \quad (4)$$

Oxygen and hydrogen gas can be generated at noble metal electrodes by the electrolysis among sea water:
+ Electrode (anode):

$$4OH- \leftrightarrow 2H2O + O2 + 4e- \quad (5)$$

- Electrode (cathode):

$$2H+\ (aq) + 2e- \leftrightarrow H2\ (g) \quad (6)$$

In case of acidic or basic water, the reactions which occur at the electrode interface are slightly different.

In water electrolysis there are no side reactions that could yield undesired by products, therefore the net balance is:

$$2H2O \rightarrow (4e-) \rightarrow O2 + 2H2 \quad (7)$$

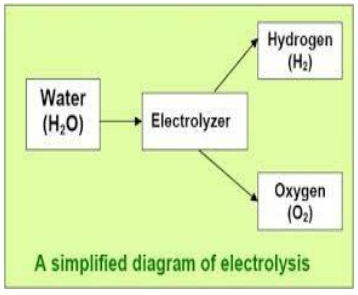


Figure 6: Simplified Electrolysis

By thus we are producing hydrogen and oxygen gases through the sea water and forming those as hydrogen peroxide [13][14][15][18][21].

In this paper the techniques are used to gain more efficiency than now using as ship fuel.

6. Proposed Modelling

6.1. Block Diagram

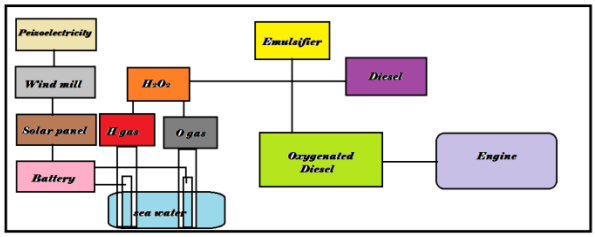


Figure 7: Block diagram to make oxygenated diesel

The electricity from the sources piezoelectricity, wind mill and solar panel are stored in the battery and the stored electrical energy is used to electrolysis process. By thus the hydrogen gas and the oxygen gas separated and converted those into hydrogen peroxide. Hydrogen peroxide is to mix with diesel adding emulsifier. Then the oxygenated diesel was formed and it is used as fuel in the ship engine.

This paper shows that small flags made by piezoelectric thin film on flexible polymers. It can efficiently act as harvesters of energy from wind at extremely low as well as high speed.

Piezoelectricity on flexible polymers is achievable by depositing a thin film of Aluminum nitrate sandwiched between metal electrodes. These metal electrodes made up with polycrystalline layers on kapton substrates. The proto type flags have a natural curling property. How means release of the residual stress of the layers.

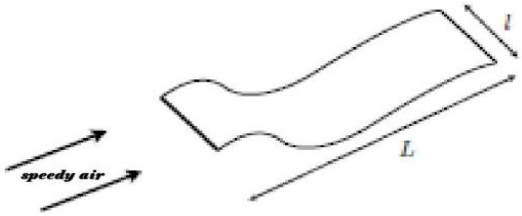


Figure 8: The two dimensional motion of a cantilevered slender flexible plate in the axial flow.

Figure 9: The model of piezoelectric flag.

The figure 8 denotes the two dimensional motion of a cantilevered slender flexible plate in the axial flow. Where L is the length and l is the span of the flag. The figure 9 is the model of piezoelectric flag. Where here the flexible plate that is black in color is covered on each side by piezoelectric plates that are gray in color. When the air hits the flag by its velocity then there mechanical energy occurs and it is converted as the electrical energy. For that each piezoelectric patch pair is connected to a dissipative circuit as by below figure 10. Its electrical equivalent circuit is in the below figure 11. Where q is the charge, v is the voltage, c is the capacitance, x is the piezoelectric coupling and g denotes the galvanometer.

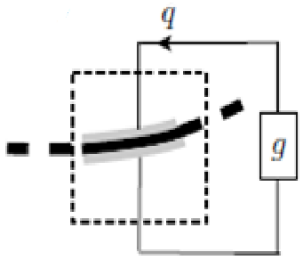


Figure 10: That each piezoelectric patch pair is connected to a dissipative circuit.

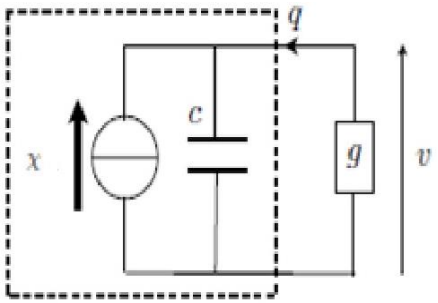


Figure 11: Equivalent electrical circuit for the above one.

The maximum power depends on piezoelectric material property and the velocity of wind. In the electrical equivalent circuit we apply the various capacitance values. By thus in the electrical equivalent circuit C=0.1µf then the output voltage and stored energy according to time is:

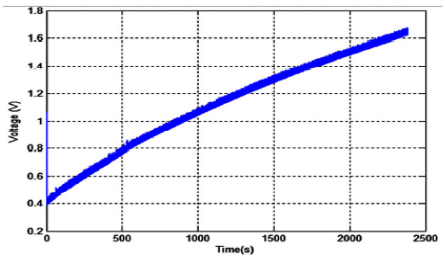


Figure:12 output voltage for c=0.1µf

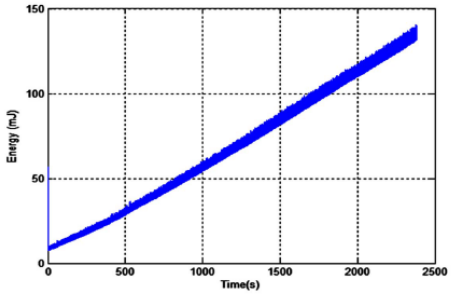


Figure:13 stored energy for c=0.1µf

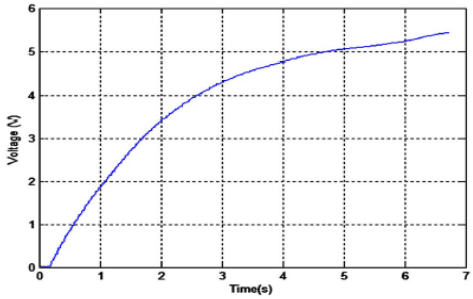


Figure:14 output voltage for c=22µf

In the electrical equivalent circuit C=22µf then the output voltage and stored energy according to time is

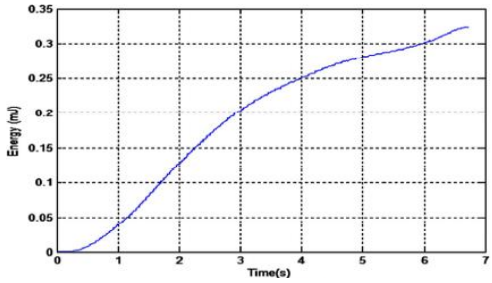


Figure:15 stored energy for c=22µf

In the electrical equivalent circuit C=470µf then the output voltage and stored energy according to time is

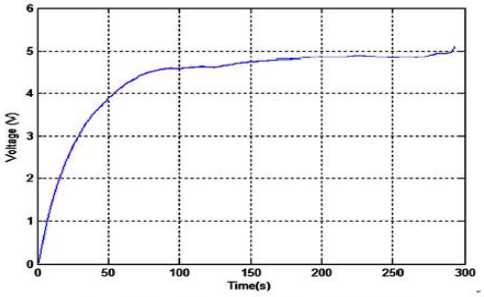


Figure:16 output voltage for c=470µf

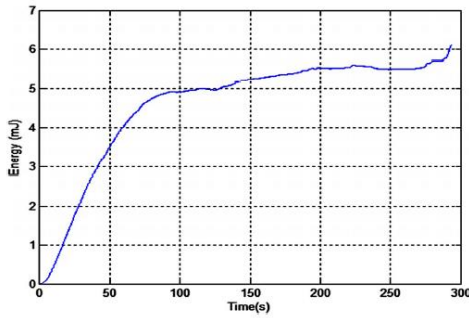


Figure:17 stored energy for c=470µf

From the practical point of view 0.1µf gives 5.5V as maximum output, 22µf gives 10V as maximum output and 470µf gives 25V as maximum output, however the speed of the wind and property of the piezoelectric material determines the efficiency of the piezoelectricity. By thus the below figure clearly describes the current formation according to the wind speed.

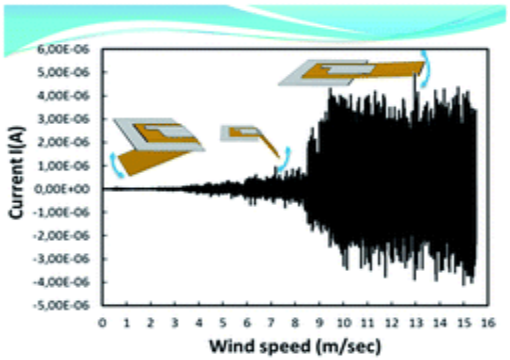


Figure:18 current formation according to wind speed

And then in the wind mills lift and drag forces made the wind mill to a motion. Drag forces are characterized by slower rotational and high torque capabilities. Lift power have much higher rotational speed than drag. So that lift powered one is well suited for electricity generation. It have maximum tip speed ratio around 10 while drag is approximately 1. The lift and drag forces shown in below:

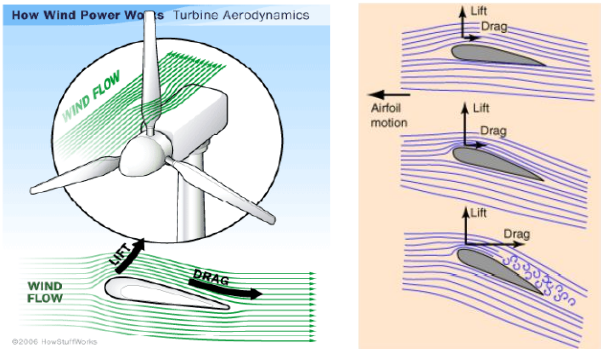


Figure:19 Action of lift and drag forces

So the lift force is effort to us. By applying this according to wind speed the power density and the turbine output is as follow as for the drag force:

Wind Speed kmph	Wind speed m/s	Power Density Watts/m2	Turbine Output 30% efficiency
1	0.278	0.013	0.004

For the lift force

Wind Speed kmph	Wind speed m/s	Power Density Watts/m2	Turbine Output 30% efficiency
10	2.778	12.860	3.858
25	6.944	200.939	60.282
50	13.889	1607.510	482.253
75	20.833	5425.347	1627.604
100	27.778	12860.082	3858.025
125	34.722	25117.348	7535.204

The following plot gives the relation between wind speed in KMPH and the power density.

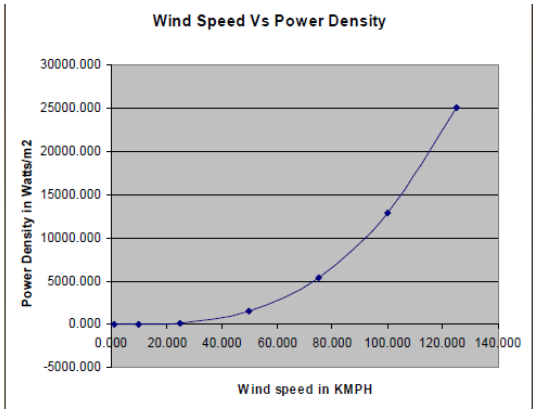


Figure:20 Relation between wind speed in KMPH and the power density

Then the solar panel, Photo voltaic effect is converting solar energy to electrical energy by the means of solar cells. Photo

voltaic panel consists of a group of solar cells. Solar cells are predominantly made from a semiconductor. Photo voltaic cells have two types one is positively charged and another one is negatively charged. When light shines on the semiconductor, the electric field across the junction between these two layers that is positively and negatively charged causes an electric current. The greater intensity of light gives possible greater flow of electricity. This function is shown below:

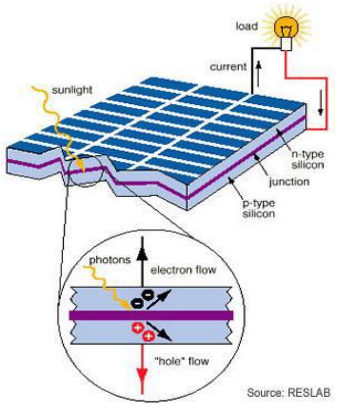
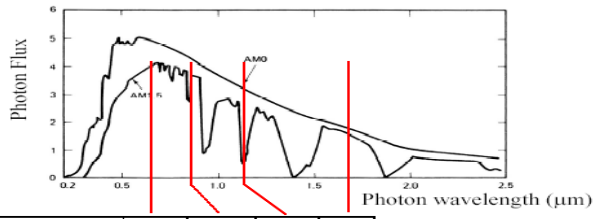


Figure:21 current production through solar panel

The efficiency of the photo voltaic cell fully depends on the intensity of light and the property of the semiconductor. The maximum efficiency of various semiconductor materials as shown in the tabulation.



Material	a-Si	GaAs	c-Si	Ge
Band gap	1.7eV	1.45eV	1.1eV	7eV
Max Efficiency	26%	29%	27%	13%

Figure:22 The maximum efficiency of various semiconductor materials

Pure silicon has the most efficiency while compared with others. So we are using the silicon type.

At last hydrogen peroxide, during electrolysis process we may separate the sea water as hydrogen gas as well as oxygen gas. When we mingle those gases then we may easily form the hydrogen peroxide.

Hydrogen peroxide is not combustible but it is a strong oxidizer. It may ignite combustibles like wood, paper and oil. By thus we might mix the hydrogen peroxide with diesel. It'll not blend directly but if we use the emulsifiers then the expectable one acceptable for us. Then the ordinary diesel becomes like a oxygenated diesel. The emulsifier consists of 2.60% of N,N-diethylmethylamine, 15.20% of N-methyl-2-pyrollidone, 1.10% of carboxyl methyl cellulose, 0.70% of sodium hexameta phosphate.

In the practical process pure diesel has the stability and it is considered as sample A. Add 10 ml of emulsifier and 2.53% of hydrogen peroxide with the pure diesel. It also has the stability. It is in below picture considered as sample B.

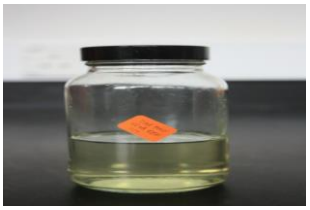


Figure:23 10 ml of emulsifier and 2.53% of hydrogen peroxide with the pure diesel

Now we add 20 ml of emulsifier and 3.50% of hydrogen peroxide with the pure diesel. It has the stability shown below named as sample C.

Figure:24 20 ml of emulsifier and 3.50% of hydrogen peroxide with the pure diesel

Then we add 40ml of emulsifier and 6.34% of hydrogen peroxide with the pure diesel. Now also it has the stability. It is named as sample D.

Figure:25 40ml of emulsifier and 6.34% of hydrogen peroxide with the pure diesel

When we add 60 ml of emulsifier and 10.92% of hydrogen peroxide it has stability. It is denoted as sample E.

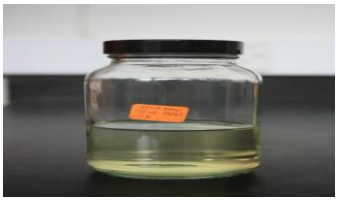


Figure:26 60 ml of emulsifier and 10.92% of hydrogen peroxide with pure diesel

Adding 80 ml of emulsifier and 15.75% of hydrogen peroxide then also it has the stability considered as sample F.

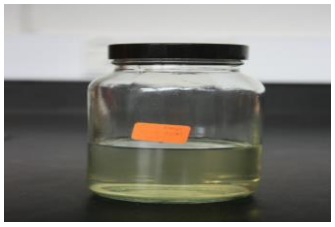


Figure:27 80 ml of emulsifier and 15.75% of hydrogen peroxide

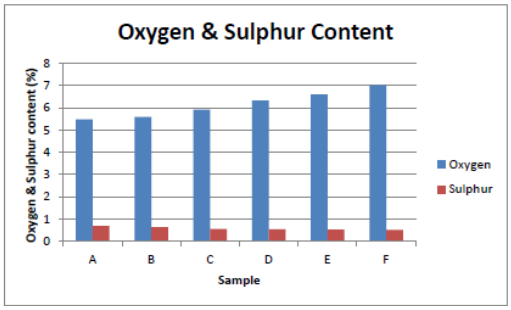
Hydrogen peroxide content and stability status of oxygenated diesel samples.

Sample	Diesel (ml)	Emulsifier (ml)	H2O2 Mass (%)	Stability
A	100	0	0.00	stable
B	100	10	2.53	stable
C	100	20	3.50	stable
D	100	40	6.34	stable
E	100	60	10.92	stable
F	100	80	15.75	stable

Density, viscosity and pH of the oxygenated diesel

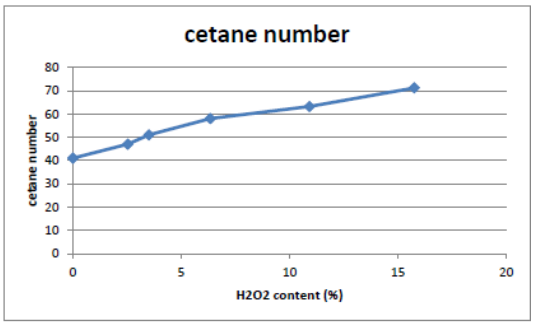
Sample	Density(kg/m^3)	Viscosity(cst)	pH
A	842.21	2.22	5.09
B	836.39	2.65	5.28
C	846.04	2.74	5.46
D	842.21	3.12	5.56
E	833.47	3.55	5.67
F	830.51	4.71	5.72

The function of fuel oxygenates is to increase the oxygen content of the fuel to promote more complete and better combustion. The oxygen and the sulphur content level is the parameter to measure the quality of the fuel. Here we use the diesel as the fuel. As by oxygen and sulphur content of the samples.



The chart shows a steady raise of oxygen content in the diesel samples. This clearly shows increasing the hydrogen peroxide amount then the oxygen content also increases. The increasing of oxygen content results in more complete combustion of diesel in compression combustion. Simultaneously the oxygenated diesel reduces the emission of green gases.

Cetane number is used to determine the compression combustion quality of the diesel in the engine. For the samples



From the experiment for pure diesel that is sample A the cetane number is 41. For the sample F the cetane number is 71.2. It shows that the addition of hydrogen peroxide results in combustion improvement.

7. CONCLUSION

The application of hydrogen peroxide as fuel oxygenates improves the performance of the diesel in several ways. Oxygenated diesel samples are found to have better combustion performance and more environmental friendly due to higher cetane number.

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