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HHO Gas with Bio Diesel as a Dual Fuel with Air preheating Technology

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Abstract

The increasing industrialization of the world has led the demand of petroleum based fuels. fossile fuels are obtained from limited reserves. These finite reserves are highly concentrated in certain regions of the world. Therefore, those countries not having these resources are facing energy/foreign exchange crisis, mainly due to the import of crude petroleum. Hence, it is necessary to look for alternative fuels which can be produced from resources available locally within the country such as alcohol, biodiesel, vegetable oils etc. This work focus on the production, characterization of bio-diesel and it can be aided with the oxy-hydrogen gas which can be produced by the electrolysis process from the water. This oxy- hydrogen gas has been pre heated with the help of waste heat recovered from the automobile exhaust. The use of water powered biodiesel in conventional engines result in substantial reduction in emission of unburned hydrocarbons, carbon monoxide and particulate. Also this pre heating of the air improves the thermal efficiency and reduce the vibration of the engine.

Keywords: Bio-diesel;Hydrocarbons; pre-heating; Oxy-hydrogen gas; petroleum fuels; Unburned fuels.

I.INTRODUCTION

The present energy scenario has stimulated active research interest in non-petroleum, renewable, and non-polluting fuels. Use of various fossil fuels such as petroleum products and coal lead to several environmental problems such as reduction in underground-based carbon energy sources, serious modifications in earth's surface layer, subsidence of ground surface after extraction of fuels and minerals

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etc. These CO2 levels are still climbing as a function of fuel burnt leading to greenhouse effect, acid rains, smog and change of climate world-over. this paper deals with implementation of oxy-hydrogen which is extracted from water which is act as a dual fuel with bio-diesel which is obtain from the waste vegetable oils. This will improve the performance of the engine such as increase in efficiency, improved mileage and reduction of co2 and co compounds and reduction of smoke. The air preheating can be achieved by the Waste heat recovery with help of Recuperators.

II.BIO-DIESEL

The best way to use vegetable oil as fuel is to convert it in to biodiesel. Biodiesel is the name of a clean burning mono-alkyl ester-based oxygenated fuel made from natural, renewable sources such as new/used vegetable oils and animal fats. The resulting biodiesel is quite similar to conventional diesel in its main characteristics. Biodiesel contains no petroleum products, but it is compatible with conventional diesel and can be blended in any proportion with mineral diesel to create a stable biodiesel blend. Biodiesel viscosity comes very close to that of mineral diesel hence no problems in the existing fuel handling system. Flash point of the biodiesel gets lowered after esterification and the cetane number gets improved.

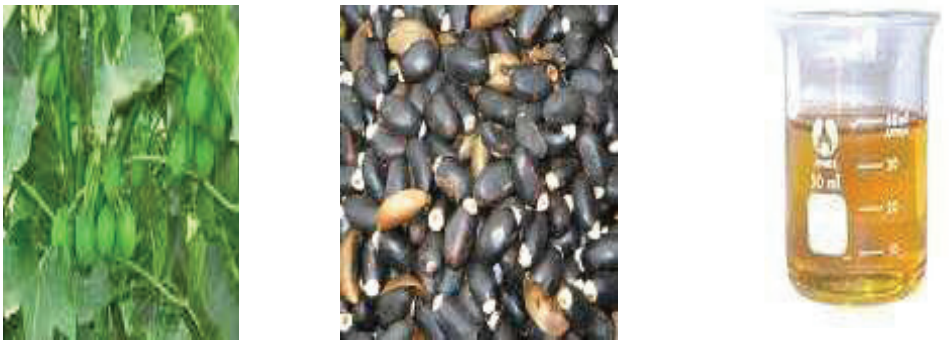

Fig.1.Bio-diesel samples with source jatropa seeds

Even lower concentrations of biodiesel act as cetane number improver for biodiesel blend. Calorific value of biodiesel is also found to be very close to mineral diesel. Some typical observations from the engine tests suggested that the thermal efficiency of the engine generally improves, cooling losses and exhaust gas temperature increase, smoke opacity generally gets lower for biodiesel blends. Possible reason may be additional lubricity properties of the biodiesel; hence reduced frictional losses (FHP). The energy thus saved increases thermal efficiency,cooling losses and exhaust losses from the engine. The thermal efficiency starts reducing after a certain concentration of biodiesel. Flash point, density, pour point, cetane number, calorific value of biodiesel comes in very close range to that of mineral diesel.

III.WATER

One of the huge available energy resources is water. Water consists of two molecules of hydrogen and one molecule of oxygen. The atomic number of oxygen is 16 and the atomic number of hydrogen molecule is 2. So the atomic number of the water molecule is 18/gm. Water is used as the fuel for the engine by separating the gases such as hydrogen and oxygen present in the water through the electrolysis process. The term “ELECTROLYSIS” is defined as the process of separating the positive and negative

ions present in the electrolyte by passing the direct current in the solution. This is aided with the bio-diesel to improve the efficiency of the engine and reduction of harmful compounds.

IV.PRODUCTION OF BIO-DIESEL

The biomass sources particularly vegetable oils have much importance as a renewable energy source and as a fuel They have higher viscosity and suited only for small engines for a short-term period due to excessive carbon build up in the combustion chamber and power loss due to severely choked injectors. For the long-term use and for heavy engines, the triglycerides in the oils have to be converted into less viscous mono-alkyl esters, called as biodiesel, comparable to diesel fuel using alcohols and catalysts through transesterification

A .*Raw materials*

At present, raw materials for producing biodiesel is refined or semi-refined vegetable oil from soybean, sunflower, rapeseed, palm, peanut, jatropha, pongamia, micro algae, waste cooking oil, waste tallow and other cheap materials

B. *Biodiesel Production Technologies*

The transesterification process can be carried out by batch or continuous system. In the transesterification process vegetable oil is reacted with an alcohol, commonly methanol and this reaction would be catalyzed by bases, acids or enzymes.

C. *Transesterification*

Vegetable oils have to undergo the process of transesterification to be usable in internal combustion engines. Transesterification is the reaction of a fat or oil with an alcohol to form esters and glycerol. Alcohol combines with the triglycerides to form glycerol and esters. A catalyst is usually used to improve the reaction rate and yield. Since the reaction is reversible, excess alcohol is required to shift the equilibrium to the product side. Among the alcohols that can
be used in the transesterification process are methanol, ethanol, propanol, butanol and amyl alcohol. The process of transesterification brings about drastic change in viscosity of vegetable oil. The biodiesel thus produced by this process is totally miscible with mineral diesel in any proportion. Biodiesel viscosity comes very close to that of mineral diesel hence no problems in the existing fuel handling system. Flash point of the biodiesel gets

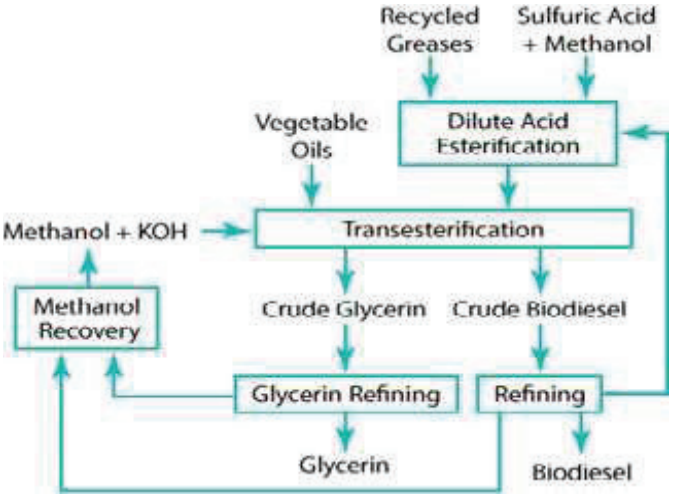

Fig.2.Bio-diesel production

lowered after esterification and the cetane number. gets improved. Even lower concentrations of biodiesel act as cetane number improver for biodiesel blend. Calorific value of biodiesel is also found to be very close to mineral diesel.

V.PRODUCTION OF OXY-HYDROGEN

Water is used as the fuel for the engine by separating the gases such as hydrogen and oxygen present in the water through the electrolysis process. The term "ELECTROLYSIS" is defined as the process of separating the positive and negative ions present in the electrolyte by passing the direct current in the solution.

A . *Electrolysis*

Electrolysis is the method of separating bonded elements and compounds by passing an electric current through them. In an ionic compound, in this case, salt is dissolved with an appropriate solvent, such as water, so that its ions are available in the liquid. An electrical current is applied between a pair of inert electrodes immersed in the liquid. The negatively charged electrode is called as cathode and the positively charged one as anode. Each electrode attracts ions which are in result of opposite charge. Therefore, positively charged ions (called as cations) move towards the cathode, while negatively charged ions (termed anions) move toward the anode

B . *Catalysts*

Catalysts are the substance in which it alters the speed of reaction. In this process we are using the catalyst to increase the seed of the production of oxy-hydrogen gas from the water. In our study, we are using potassium hydroxide as a catalyst which is good in separating the hydrogen bonds from water. This catalyst is effective in the production of the Oxy-hydrogen gas from the water.

C .*Electrodes*

In this process we are using "STAINLESS STEEL" plates as electrodes. For getting higher efficiency we are using 4 plates which are immersed in the electrolyte solution. The electrolyte solution is nothing but the mixture of water and catalyst potassium hydroxide crystals.

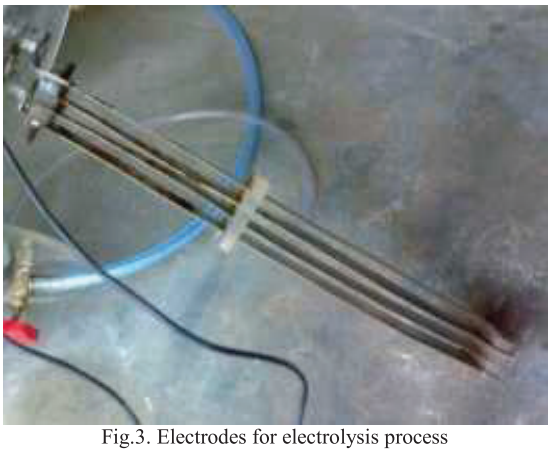

Fig.3. Electrodes for electrolysis process

D .*Bubbler Unit*

The bubbler unit is an important component used in the process. The handling of hydrogen gas more than 2500psi is very difficult. It will lead to blast. To avoid this problem, we are using the unit named as bubbler unit. The oxy-hydrogen produced in the production chamber has to be transferred in to the bubbler unit. After that gas has to be transferred to the air filter. In case of any explosion, the bubbler unit will avoid the blast of the production chamber. If the bubbler unit is absent then the production unit will blast.

Fig.4.Oxy-hydrogen production

VI.AIR PREHEATING TECHNOLOGY

The oxy hydrogen gas has been produced by electrolysis process. After the gas produced , it is passed in to the inlet manifold of the CI engine. Before the gas enters in to the inlet valve it is preheated with the help of recuperators.

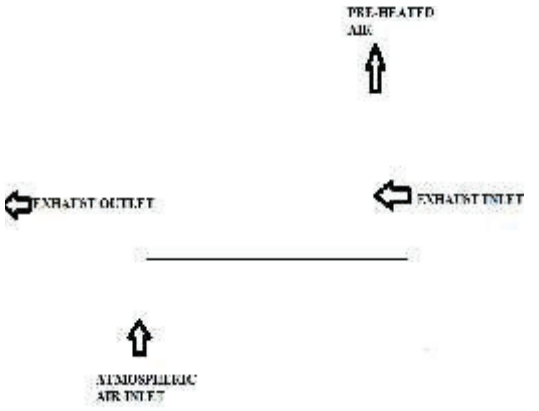

Fig.5. Sample image for Air Preheating

The recuperator consist of copper tubes with having the capability of high thermal conductivity. This can be used to transfer the heat from the exhaust gas to the produced oxy hydrogen gas. Copper tubes which are present inside the recuperator plays an vital role in the heat transfer from the exhaust gas to the atmospheric gas. The copper tubes are good conductor of heat . it undergoes convection heat transfer form exhaust gas to the copper tube and from the copper tube to atmospheric air it again under goes the convection. Through this the heat which is present in the exhaust gas has been transferred in to the atmospheric air.

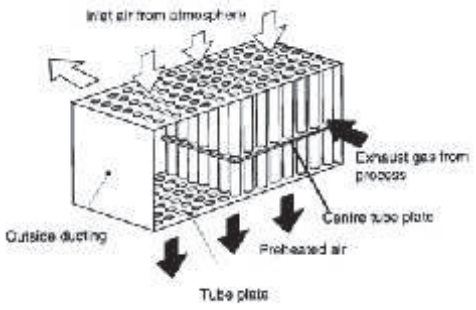

Fig.6. Arrangement of Copper Tubes inside the Recuperator

The above image shows the detailed information about the arrangement of the copper tubes inside the recuperators. The air from the production chamber is enters to the recuperator from the top and the exhaust gas from the engine enters to the recuperator from the side. The heat from the exhaust gas has been transferred to the copper tube. From the copper tube the heat is transferred to the oxy hydrogen gas.

VII.COUPLING OXY-HYDROGEN WITH BIO-DIESEL

The bio-diesel is used 100% without any blending and also it has been used 10%, 20%, 30% blending with the conventional diesel. with this the produced oxy-hydrogen gas has been passed in to the recuperator. From the recuperator the oxy hydrogen gas has been pre heated by waste heat recovery technology and the preheated air is passed in to the inlet manifold of the engine cylinder. this oxy-hydrogen gas is mixed with the bio-diesel and this gas improves production by adding the concentration of the catalyst and due to increase in pressure of the oxy hydrogen gas will improve the burning capacity of the bio diesel and also neutralizes the carbon bonds present in the bio-diesel and improve the combustion of the engine in the combustion chamber. it will reduces the causing of unburned hydrocarbons and unburned fuels caused in the combustion chamber.

VIII.FINDINGS

The oxy-hydrogen with bio-diesel will creates the experiment we have observed that "Lean-mixture-ratio combustion in internal-combustion engines which has the potential of producing low emissions and higher thermal efficiency.

- Reduces the formation of unburned hydrocarbons and reduces the unburned fuel in the combustion chamber.
- Due to this the combustion process will done in efficient manner and the hydrogen is four times highly effective when compare to ordinary fuels.

- Due to this it will increase the combustion reaction and leads to increase in efficiency and torque and horse power of the engine.
- The HHO compounds will used to reduce in the formation of carbon dioxide and carbon monoxide and other harmful compounds produced in the engine and increase in mileage and performance of the engine
- Heat energy is recovered from the exhaust gases,which causes lower heat addition, thus improving engine thermal efficiency.
- NOx emission is reduced with the exhaust heat recovery system. Higher inlet air temperature is caused the lower ignition delay, which is responsible for lower NOx formation with air preheating. Uniform or better combustion is occurred due to pre heating of inlet air, which also causes lower engine noise.
- Due to better evaporation and shorter ignition delay, there is less fuel adhering to the combustion chamber wall and therefore small amount of fuel accumulated in the combustion chamber before ignition is started which may produce low NOx emission as well as low noise and vibration.

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