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DESIGN AND FABRICATION OF HYBRID BIFUEL VEHICLE USING ETHANOL

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Abstract--- ***Alternate fuels are derived from resources other than petroleum. Some are produced domestically, reducing our dependence on imported oil, and some are derived from renewable sources. Often, they produce less pollution than gasoline or diesel. The importance of world oil supply and demand, its price fluctuations, and political instability in oil producers caused energy crisis and suffered world economic. In addition, environmental problems, air pollution and global warming, have become urgent issues for all to concern. Emission from burning fossil fuels is a major attribution to air quality, mainly big cities dense in population and vehicles. Agricultural products like sugar cane and cassava are suitable feedstock for ethanol production. Ethanol is a renewable energy source that can be produced from just about anything containing carbon. potential source includes natural gas, coal, and biomass. Currently most methanol is produced from natural gas, or methane, using steam, pressure, and a catalyst. LPG is obtained from the process of natural gas and crude oil extraction and as by product of oil refining. Its primary composition is a mixture of propane and butane. Ethanol and gasohol, the blend of gasoline and ethanol, methanol are proved to be used as an alternative fuel in automobiles.***

At present, the premium gasoline 95 is gradually replaced by gasohol, E40, M40 and E20, M20 and finally phased out. Ethanol is a potential clean fuel with similar characteristics to gasoline; the study of the use of highly blend ethanol, fuels like E85, 85%vol ethanol blended with 15% gasoline, Methanol M85, 85%vol methanol blended with 15% gasoline, in the 4-stroke motorcycles is encouraged. Because motorcycles are necessary vehicles for low and middle incomes, over 20 million motorcycles consuming gasoline have been used national wide. The study of the use of E85, M85, LPG as an alternative fuel in a used motorcycle carburetors type will be conducted in 2 areas, that is, fuel consumption and emission.

Keywords : Emission, Ethanol, Gasohol, Fuel Consumption.

I.INTRODUCTION

A biofuel is a fuel that is produced from living organisms, most often referring to plants or plant-derived materials. Plant fixes atmospheric CO_2 via photosynthesis to produce polysaccharides, such as cellulose and hemicellulose. Because biofuels are produced from the plant-derived polysaccharides, CO_2 does not increase when biofuels are used (combusted), which refers to the concept of carbon neutrality. Thus, use of biofuels is an effective way to combat against the global climate change by reducing CO_2 emission. Non-food-based biomass including rice straw, corn stover, forest thinning residues are promising resources for biofuel production since use of non-food-based biomass does not compete with food production with respect to land use.

Our bioprocess, so-called growth-arrested bioprocess solved these technical hurdles. Thanks to independence of microbial growth for biofuel production, the growth-arrested bioprocess maintains productivity even in the presence of the inhibitory compounds. We developed genetically engineered strain of Corynebacterium glutamic that can utilize pentose and hexose simultaneously and efficiently. We continue to improve the growth-arrested bioprocess by metabolic engineering and process engineering to realize biorefinery.

There are two technical hurdles to realize biofuels from non- food biomass: 1) technology for efficient conversion of pentose to biofuel, 2) mitigation of fermentation inhibition by organic compounds (aromatics, organic acids and furans) derived from non-food biomass. Although polysaccharides composed of non-food biomass contain pentose sugars (xylose and arabinose) as well as hexose sugars (glucose, mannose and galactose), microorganisms currently used in industrial bioprocess are incapable of utilizing pentose sugars, leading to low yield of biofuels. Inhibitory compounds are produced in a thermochemical treatment step (referred to pre-treatment) of non-food biomass, but this step is required for efficient enzymatic saccharification of biomass. These inhibitory compounds cause low yield and productivity of bioprocess.

II. LITERATURE REVIEW

A.BIO-FUEL

Biofuel is a type of renewable energy source derived from microbial, plant, or animal materials. Examples of biofuels include ethanol (often made from corn in the United States and sugarcane in Brazil), biodiesel (sourced from vegetable oils and liquid animal fats), green diesel (derived from algae and other plant sources), and biogas (methane derived from animal manure and other digested organic material).

Global demand for energy is expected to continue growing substantially and it's widely recognized that alternative, sustainable solutions need to be found to address those needs. Lots of people in the energy industry believe biofuel could be the answer, viewing it as vitally important to future energy production because of its clean and renewable properties.

Biofuel functions similarly to non-renewable fossil fuels. Both burn when ignited, releasing energy that can be used to power cars or heat homes. The main difference between them is that biofuels can be grown indefinitely and generally cause less damage to the planet.

Many of the world's major oil companies are now investing millions of dollars in advanced biofuel research, including Exxon Mobil Corp. (XOM). America's largest oil company is focusing on advanced biofuels that do not compete with food or water supplies, with most of its allocated funds dedicated to transforming algae and plant waste into fuel that can be used for transportation.

B. SELECTION OF BIO-FUEL

The biofuel is produced from any food products or trees, this act can cause food scarcity and lead to the extinction of the species of tree. To overcome these types of problems, we can choose Ethanol as our fuel. The preparation of ethanol is done from the waste of sugar production. This method of manufacturing biodiesel does not affect the environment and tends to productive path of development. Sugarcane feedstock mainly consists of sugar in the form of disaccharide (sucrose), which is readily fermented into ethanol by S. cerevisiae. The process of making ethanol from sugarcane starts when cane stalks are crushed to extract a sugar-rich cane juice. When cane stalks passed through extractor/expeller, cane juice is collected and delivered to a fermentation tank where the yeast fermentation reaction occurs to generate ethanol. The leftover fibrous residue called bagasse (45-50% moisture content) after juice extraction process is commonly combusted to generate heat/electricity for in-plant use. After fermentation, the fermentation broth containing approximately 5-12% ethanol by weight is now called beer. The beer is delivered to distillation column where the ethanol is recovered, and the liquid residue known as vinasse is co-generated at the bottom of distillation column. At this process, the purity of ethanol can be up to 92-95% therefore further water separation process is required. Commonly, dehydration of the residual water is carried out using molecular sieves resulting in the final product, a fuel-grade anhydrous ethanol (200 proof or >100% ethanol).

II. DESCRIPTION OF EQUIPMENT

FUEL INJECTOR

A fuel injector is an electronically controlled mechanical device which is used to inject/spray (just like a syringe) the fuel into the engine for the preparation of correct air-fuel mixture which in turn provides efficient combustion to the engine. The position of the fuel injectors differs for different engine designs but usually they are mounted on the engine head with a tip inside the combustion chamber of the engine.

CYLINDER

A cylinder is a vital part of the engine. It's a chamber where fuel is combusted, and power is generated. The cylinder consists of a piston and two valves at the top: an inlet and exhaust valves. The piston moves up and down, and its reciprocating motion generates power that moves your vehicle.

CYLINDER HEAD

In an internal combustion engine, the cylinder head (often informally abbreviated to just head) sits above the cylinders on top of the cylinder block.[1] It closes in the top of the cylinder, forming the combustion chamber. This joint is sealed by a head gasket. In most engines, the head also provides space for the passages that feed air and fuel to the cylinder, and that allow the exhaust to escape. The head can also be a place to mount the valves, spark plugs, and fuel injectors.

SPARK PLUG

The spark plug is a fundamental component of your bike's ignition system. Voltage is sent into the plug from its base, jumping from a center electrode to a grounded electrode, creating a spark. This spark ignites the air-fuel mixture in the combustion chamber, causing an explosion that starts the engine power stroke.

CRANK

A crank is an arm attached at a right angle to a rotating shaft by which circular motion is imparted to or received from the shaft. When combined with a connecting rod, it can be used to convert circular motion into reciprocating motion, or vice versa. Attached to the end of the crank by a pivot is a rod, usually called a connecting rod (conrod).

CRANKSHAFT

A crankshaft is a shaft driven by a crank mechanism, consisting of a series of cranks and crankpins to which the connecting rods of an engine is attached. In a reciprocating engine, it translates reciprocating motion of the piston into rotational motion, whereas in a reciprocating compressor, it converts the rotational motion into reciprocating motion. In order to do the conversion between two motions, the crankshaft has "crank throws" or "crankpins", additional bearing surfaces whose axis is offset from that of the crank, to which the "big ends" of the connecting rods from each cylinder attach.

CRANKCASE

A crankcase is the housing for the crankshaft in a reciprocating internal combustion engine. In most modern engines, the crankcase is integrated into the engine block. Two-stroke engines typically use a crankcase-compression design, resulting in the fuel/air mixture passing through the crankcase before entering the cylinder(s). This design of the engine does not include an oil sump in the crankcase.

CONNECTING ROD

A connecting rod is the part of a piston engine which connects the piston to the crankshaft. Together with the crank, the connecting rod converts the reciprocating motion of the piston into the rotation of the crankshaft. The connecting rod is required to transmit the compressive and tensile forces from the piston. In its most common form, in an internal combustion engine, it allows pivoting on the piston end and rotation on the shaft end.

PISTON

A piston of reciprocating engines, reciprocating pumps, gas compressors, hydraulic cylinders and pneumatic cylinders, among other similar mechanisms. It is the moving component that is contained by a cylinder and is made gas-tight by piston rings. In an engine, its purpose is to transfer force from expanding gas in the cylinder to the crankshaft via a piston rod and/or connecting rod. In a pump, the function is reversed, and force is transferred from the crankshaft to the piston for the purpose of compressing or ejecting the fluid in the cylinder. In some engines, the piston also acts as a valve by covering and

III.WORKING PRINCIPLE

The experimentation is carried out in the normal TVS Apache 150 bike engine. The type of the engineis 4-Stroke Air Cooled OHC. It is the air cool type engine with displacement 147.5 cc. The maximum power and torque of the engine is 13.7 bhp @ 8500 rpm and 12.3 Nm @ 6000 rpm respectively. The process of production of ethanol from sugar or grain is well known. In contrast with methanol production, the process does not require extreme temperature and pressure and thus very small units are possible.

The performance of the IC engine is tested with pure gasoline and ethanol blends. The degree of success is compared based on specific fuel consumption, Brake means effective pressure, specific power output, specific weight and Exhaust smoke and other emissions.

The Total Fuel Consumption (TFC) *vs* Break Power (BP) for pure gasoline and ethanol blend E10, E20 and E25.

From it is noticed that TFC in Gasoline is little high compared with E Blend. It indicates that the E Blend yields better economy compared to pure gasoline. The Specific Fuel Consumption (SFC) *vs* Break Power (BP) for pure gasoline and ethanol blend E10, E20 and E25.

From it is ensured that the gasoline fuel has high SFC. The E Blends yields better fuel economy in various percentages. If percentage of E Blend increases SFC also increases. BP versus Indicated Power is plottedfor gasoline and E Blends.

From it is noticed that the value of IP is lessfor E10 Blend and the value increases if the percentage of Blend increases. The indicated thermal efficiency, brake thermal efficiency and mechanical efficiency of gasoline compared with E10 Blend ethanol.

After comparison of gasoline and the ethanol- gasoline blends as various perspectives the improved performance of ethanol-gasoline blends was obtained from the comparison graphs. From the Fig. 4 it is proved that there is a significant increase in the mechanical efficiency of E10 Blend compared with Gasoline.

In mechanical efficiency point of view E10 only gives the better output. In other efficiencies the ethanol-gasoline blends provide better output compared with gasoline output. BP *vs* variousefficiencies for E25 Ethanol is compared and plottedagainst pure gasoline.

Several researchers have investigated the use of LPG in SI engine. Scientists and researchers have done numerous experimental and theoretical investigations on SI engine fueled with LPG at different operating parameters and conditions and promising results have been obtained with regard to thermal efficiency, fuel economy and exhaust emission point of view. In studies carried out it was found that at the range of lean-to stoichiometric equivalence ratios, the flame propagation speed of LPG is faster than of gasoline but at rich mixture gasoline has the higher flame speed. Due to the high flame propagation speed of LPG at lean mixture, combustion characteristics of LPG are superior to that of gasoline in lean burn engines

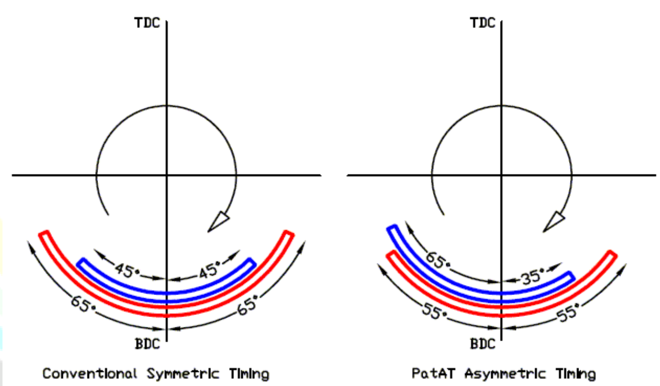

Fig: Timing Diagram

In spark ignition engines, the fuel normally mixed with air in the engine intake system. Combustion of the fuel-air mixture reacted inside the engine cylinder controls engine power, efficiency, and emissions. If oxygen is sufficient, a hydrocarbon fuel can be completely oxidized. That is, the carbon in the fuel is then converted to carbon dioxide CO_2, and the hydrogen to water H_2O. Exhaust gascomposition depends upon the relative proportions of fuel and air fed to the engine, fuel composition, and completeness of combustion. In practice, the exhaust gas of an internal combustion engine contains complete combustion products; CO_2 and H_2O, as well asincomplete combustion products; CO, H_2, unburned hydrocarbons, and soot. Under fuel rich operating conditions, the amounts ofincomplete combustion products become more substantial since oxygen is insufficient to complete combustion inside the cylinder.

The stoichiometric air-fuel ratio or fuel-air ratio depends on fuel composition. Fuel-air mixtures with more than or less than the stoichiometric air requirement can be burned. With excess air or fuel-lean combustion, the extra air in unchanged forms appears in the products. Under the fuel-rich mixtures, the incomplete combustion occurs because there is insufficient oxygen to oxidize fuel carbon and hydrogen. The incomplete combustion products are a mixture of CO_2 and H_2O and carbon monoxide CO and hydrogen H_2 as well as nitrogen N_2. Because the composition of the combustion products is significantly different for fuel-lean and fuel-rich mixtures, and because the stoichiometric air-fuel ratio or fuel-air ratios depend on fuel composition; it is more informative to define the fuel-airequivalence ratio, or the relative air-fuel ratio.

IV.CONCLUSION

Once the used 2-stroke motorcycle tested, HERO HONDA CD 100 was thoroughly inspected and well set, the comparative tests, consumption rate and emission, between the use of gasoline and E85, M85, LPG were conducted. The test steps were as follows:

1. Perform the road test – long riding and city riding
2. Periodically measure emission
3. After riding for about 50 km, then change fuel to E85, M85, and LPG respectively and repeat the steps 1 and 2.

When fueled with gasoline, the millage given by the 4-stroke engine is 36.9 km/l. For E85 the stoichiometric air-fuel ratio is about 9.87: 1 which has given a millage of 56.9 km/L. Similarly, when fueled with M85 the millage that has drawn from the 4-sroke engine is 37.0 km/l, when fueled with LPG the millage is given as46.9 km/l. The compression ratio and the ignition timing remained unchanged.

Once the engine is properly tuned up and modified, its riding performance with E85, M85, LPG fuels was as comfortable as fueling with gasoline. There was no difficulty in engine starting except that in the cold weather, it needed to choke the engine.

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