Performance Analysis of 2 Stroke Methanol based Internal Combustion Engine with Varying Proportion of Lubricant

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Abstract

Two stroke engines are extensively used in coastal regions by transportation ships and pleasure boats. Twenty to thirty percent of fuel and lubricating oil remain unburnt. This is even worse when the engine is operating at low speeds, about 40 percent of the unburnt fuel emitted directly in to the water. Lubricants plays major role in defining the percentage of exhaust pollutants because in conventional 2-stroke internal combustion engines oil is burned with gasoline or diesel. With the increase in motorization of world the need for switching to alternative fuel has increased because petroleum is a nonrenewable resource. Methanol is a great alternative fuel with low carbon content in its emission. This paper focuses on the use of methanol instead of using gasoline and diesel in 2-stroke internal combustion engine, with the use of different types of lubricants with a perception to reduce air pollution as well as reducing the consumption of gasoline by analyzing their performance.
Keywords: Pollutant, Methanol, Lubricants, 2-stroke, Carbon content

I. INTRODUCTION

As the number of pleasure boats are increasing day by day, the unburned exhaust is also increasing proportionally[1]. The number of boats in the North Sea area are estimated to be around 2 million of which 1 million of boats runs on 2-stroke engines[1]. They exhaust around 1000 tonnes of unburned engine oil with the exhaust gases in to the water [1]. Since petroleum is a Non Renewable resource, it must be saved. In June, BP provided an intriguing update to its global oil reserves estimates in the company's yearly review of energy statistics[5]. It raised its reserve estimate by 1.1% to 1,687.9 billion barrels – just enough oil to last the world 53.3 years at the current production rates[5] .In this paper different concentration of diluted methanol are used as an alternative fuel, in the 2-stroke engine with varying proportion of lubricant and there performance is recorded.

A. Methanol:

Methanol (CH_3OH), also known as wood alcohol, is considered an alternative fuel under the Energy policy act of 1992 as an engine fuel, methanol has chemical and physical fuel properties similar to ethanol[6]. Among all the alternative fuels methanol is considered to be the most promising liquid fuel[2]. Methanol can be used directly in the engine or with the gasoline, most commonly used mixtures are M85 (85% methanol and 15% gasoline) and M10 (10% methanol and 90% gasoline)[2]. Methanol can be obtained from many sources like coal, petroleum, natural gas, bio mass and even from ocean[2]. Emissions from an engine using M10 are same as those using gasoline but when M85 fuel is used there is a noticeable decrease in the hydrocarbons as well as in carbon monoxide exhaust emission [2]. Pure methanol is not used because they produce excessive wear of cylinder.

1) Advantages:

- Lower production costs—Methanol is cheap to produce relative to other alternative fuels[6].
- Improved safety—Methanol has a lower risk of flammability compared to gasoline[6].
- Increased energy security—Methanol can be manufactured from a variety of carbon-based feed stocks, such as natural gas and coal. Its use could help reduce U.S. dependence on imported petroleum[6].

Fig. 1: Methanol Used

B. Lubricants:

No engine can run without proper lubrication. A lubricating system for a two cycle crankcase compression internal engine wherein lubricant is delivered to a main bearing of the crankshaft for its lubrication[3]. The crankshaft has a throw adjacent this bearing and an oil receiving groove in a face of the throw receives oil leaking from the bearing[3]. A cross drilled passageway delivers the accumulated oil by centrifugal force to the connecting rod journal for its lubrication[3]. Methanol based engine should definitely have proper lubrication because of their wearing properties.

II. MATERIALS USED AND PROCEDURE

A. 2 Stroke Engine:

In this experiment 0.18 cm^3 capacity, 2-stroke glow plug engine is used.


Fig. 2: Two Stroke Glow Plug Engine

B. Lubricants:

Castor oil is a vegetable oil which is extracted from the seeds of castor oil plant[4]. It has better temperature viscosity property and high temperature lubrication making it useful as a lubricant[4]. This oil is used in this experiment because of its ability to mixed with the methanol and thus forming a homogeneous blend which is necessary for the proper combustion[4].

C. Method:

The fuel consumption in this experiment will be measured by the time required for the complete consumption of a measured mass of fuel, and thus by blending methanol with gasoline and with different lubricants in varying proportions, Engine fuel consumption is measured[7].

D. Fuel Type:

Table - 1
Fuel Blend with Different Percentage of Methanol and Lubricant

S.NO	*FUEL NAME*	*METHANOL*	*LUBRICANT*
1	*M85*	*85%*	*15%*
2	*M80*	*80%*	*20%*
3	*M75*	*75%*	*25%*
4	*M70*	*70%*	*30%*
5	*M65*	*65%*	*35%*

Table-2
Fuel Blend of Methanol and Lubricant by Volume

S.NO	*FUEL NAME*	*METHANOL(ml)*	*LUBRICANT(ml)*	*Total(ml)*
1	*M85*	*42.5*	*7.5*	*50*
2	*M80*	*40*	*10*	*50*
3	*M75*	*37.5*	*12.5*	*50*
4	*M70*	*35*	*15*	*50*
6	*M65*	*32.5*	*17.5*	*50*

III. RESULTS AND SUGGESTION

Table-3
Time Required for Complete Consumption of Fuel at Half Throttle

S.NO	*FUEL*	*TIME IN SECONDS*
1	*M85*	*480*
2	*M80*	*465*
3	*M75*	*447*
4	*M70*	*425*
5	*M65*	*405*

Methanol percentage was taken up to 65%, below 65% the engine was not able to run properly because of excess of oil in it. With the increase in volume of methanol time taken for complete combustion was found to be decreased and also the exhaust was found to be increased with the increase of lubricant or with the decrease of methanol. In other words it can be said that if the percentage of methanol is increased the engine will be able to run for more time, and if the amount of lubricant is increased the engine will run for less time.

In the upcoming years the conventional fuel will be completely replaced by the alternative fuel. As recorded in the table-3 methanol can be directly used with the lubricating oil. Additionally research should be done on methanol to increase its fuel consumption time.

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