IC Engine Term Paper Presentation

Topic: To analyse HRR, HR, bsfc, SOC, ffr etc for M10-diesel fuel and compare them with those for pure diesel fuel.

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Submitted To:
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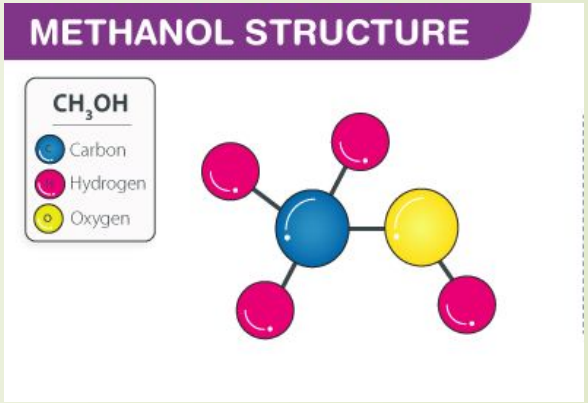
ABSTRACT

- The generation and utilization of coming-up age fuels for vehicle consumption is highly encouraged due to rising pollution and depleting availability of petroleum and like fuels.
- And among these non-conventional fuels oxygenated fuels are gaining popularity and can be used as a substitution for diesel based compression ignition engines.
- A Twin cylinder CI engine was utilized to perform tests with diesel, M10 (10% oxygenated fuel m/m respectively) under two distinct loading situations (0 Nm and 30 Nm).
- Lower load leads to longer ignition delay (compared to diesel), high load conditions resulted in faster combustion. The presence of oxygen in the fuel contributes to its high peak pressure and facilitates fast burning.

INTRODUCTION

- The diesel based engines are extremely used in the heavy duty construction and transportation works because for theses certain working condition s they are the most efficient, reliable and can last long.
- Diesel engines are known for (PM) and NOx emissions. On a positive side alternative liquid fuels like oxygenated fuels have been able to control some of these emissions more specifically the particulate matter (PM).
- Among the oxygenated fuels Methanol is an extensively studied diesel alternative for internal combustion (IC) engines keeping its easy processing, availability and low cost production in eyes.
- Methanol has high heat of vaporization and elevated inherent oxygen content 50% (m/m), hence it is believed that it will be useful in minimizing NOx and PM

- Blending of methanol with mineral diesel is one of the common methods for utilization in diesel engines. In some cases a variety of additives can be required to stabilize the blend and to improve the ignition quality



- The present study has been performed by keeping the oxygen content (m/m) in the blends of methanol and mineral diesel.

- The effect of varying mass fraction of oxygen has been investigated for combustion parameters such as in-cylinder pressure, heat release rate, combustion duration, combustion phasing etc.

- The emission characterization was also performed for gaseous emission like CO, HC and NOx along with smoke measurements.

Helping Equations

$$V(\theta) = \frac{V_s}{CR-1} + \frac{V_s}{2}(R + 1 - cos\theta - \sqrt{R^2 - sin^2\theta})$$

$$V_s = \frac{\pi d^2}{4}\Delta x$$

$$\frac{dV}{d\theta} = \frac{V_s}{2} sin\theta \left(1 + \frac{cos\theta}{\sqrt{R^2 - sin^2\theta}}\right)$$

$$CR = \frac{V_s + V_c}{V_c}$$

$$HRR = \frac{dQ_{net}}{d\theta} = \frac{\gamma}{\gamma - 1}.P.\frac{dV}{d\theta} + \frac{1}{\gamma - 1}.V.\frac{dP}{d\theta}$$

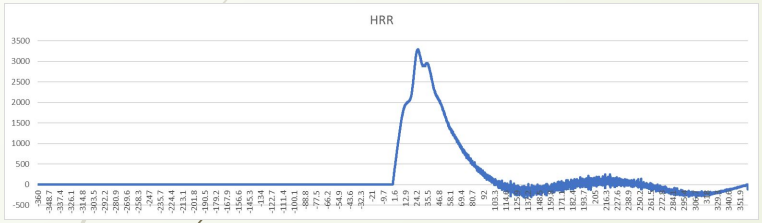
$$V_c = \frac{V_s}{CR-1}$$

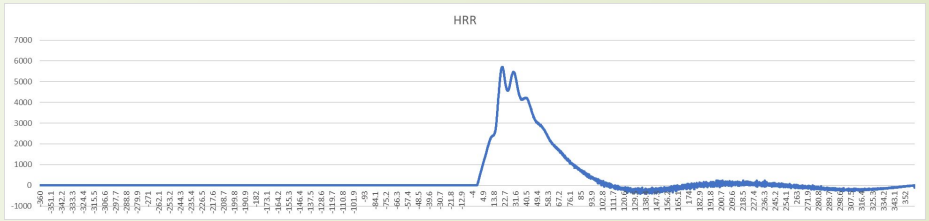
Graphs Obtained for M10-diesel fuel

0Nm Load

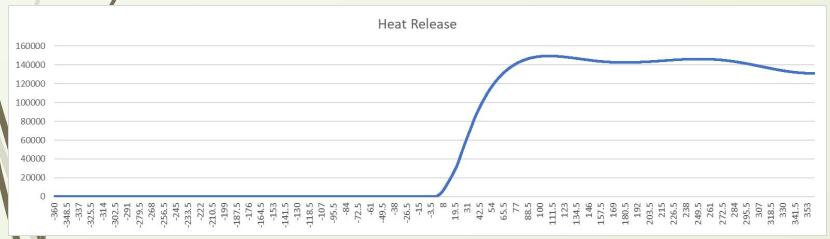
30Nm Load

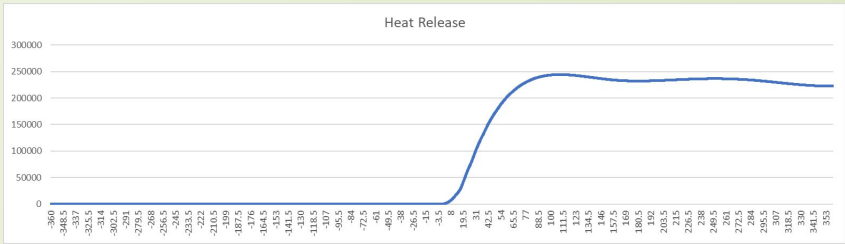
HRR





HR





Advantages of using M10-Diesel over pure diesel

- Peak pressure **increased** by 12.7%.
- Peak pressure achieved **closer to the TDC**.
- Helps **reduce carbon emissions**. For example, CO content reduced from **0.73% to 0.03%** when diesel was blended with methanol.
- Methanol is substantially **cheaper** than diesel.

Disadvantages of M10-Diesel over pure diesel

- Methanol has **lower CV** (19.7MJ/kg) as compared to that pure diesel (43MJ/kg which result in **higher bsfc** for methanol blend. **Brake power** output also decreases.

f.f.r. analysis	0Nm load	30Nm load
Diesel	38.11g/s	71.59g/s
M10-Diesel	49.2g/s	86.09g/s

- Although addition of methanol decreases emission of gases like CO, HC but on the other hand it introduces a new emission gas, formaldehyde which can cause cancer, skin irritation.

- Heat produced in one thermodynamic cycle increased from **130,064J** for diesel to **149,448.19J** for blend (for 0Nm load). Thus, brake thermal efficiency decreased.

CONCLUSION

- This study has varied the oxygen percentage in the total fuel (m/m) by blending of methanol in diesel fuel for the effects of this variation on combustion and emission characteristics.
- Diesel shows higher peak of HRR in premixed combustion phase, but methanol blend M10 shows HRR on mixing controlled combustion zone, this indicated the more uniform combustion in No load.
- For 30Nm loading condition M10 shows higher premixed and mixing controlled heat release rate compare to diesel.
- Major effects of methanol blending can be seen in the smoke emission, where it has minimized to negligible level at no load and reduced by more than 75% in 30 Nm load. Higher NO was observed for low and medium load condition and slightly lower NO was observed at higher load condition for 10% oxygen condition.

THANK YOU !