PERFORMANCE TEST ON 4 STROKE SINGLE CYLINDER DIESEL ENGINE USING DIESEL BLENDED WITH CORN ETHANOL AS A FUEL

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Objective of the project:
To study the performance of a 4-stroke single cylinder diesel engine using diesel blended with corn ethanol as a fuel. The different percentages of blends used are 10%, 20% and 100%.
To compare the brake thermal efficiency of the diesel engine uses the mixture of corn oil, ethanol and diesel as a fuel against the efficiency of the diesel engine using only diesel.
To check how much percentage of NOx produced by the engine can be reduced by incorporating an exhaust gas recirculation (EGR) system to the stationary diesel engine.

Methodology:
By using Transesterification process the corn oil is converted into biodiesel. In this process we have used ethanol as an alcohol and sodium hydroxide as a catalyst. After the reaction the oil transforms from pale yellow to reddish brown colour. Then it is transferred to separating flask and it was allowed to settle down. After some time two distinct phases were formed upper one is biodiesel and the lower one is glycerol. They are separated by sedimentation and biodiesel is washed with lukewarm distilled water. In order to blend the biodiesel with diesel 2% of surfactant called span 80 additive is added.
Applying the different loads on 4 stroke single cylinder diesel engine and varying the percentage of biodiesel in diesel the performance test is carried as a regular diesel engine performance test at constant speed. The different power and efficiencies are calculated.
And an EGR system is incorporated to the stationary diesel engine, the test is carried out for B20 fuel to know the amount of NOx reduced. In this we had installed a heat exchanger to the exhaust line so that a part of exhaust gas is send through it. The heat exchanger reduces the exhaust gas temperature an sends it to inlet manifold so that it reduces the combustion temperature and hence the NOx produced from the engine.

Result:

Figure 1: Comparing diesel, B10, B20 & B100 w.r.t. Brake Thermal Efficiency
In figure: 1 we can see that the brake thermal efficiency of the engine decreases as the percentage of the biodiesel increases in the diesel. This is because when compared to diesel the viscosity and density of the biodiesel is more and hence the brake thermal efficiency of the engine decreases as the percentage of the biodiesel increases in the diesel.
When compared to B10 and B100 the brake thermal efficiency of the B20 is more. This is because of higher peak pressure and higher heat release rates when compared to B10 and B100. This is recorded actual data and there are many reasons for this like better or improved combustion, homogeneous air fuel mixing etc.

Figure 2: Comparing diesel, B10, B20 & B100 w.r.t NOx produced
In figure 2: we can see that the percentage of NO\textsubscript{x} produced by the engine decreases gradually as the percentage of the biodiesel increases in diesel. This is because, compared to diesel biodiesel blends have lower energy content this reduces the brake thermal efficiency of the engine and hence NO\textsubscript{x} is also reduced.

The percentage reduction of NO\textsubscript{x} produced by the engine for B10, B20 and B100 are 10%, 8% and 12% respectively.

![Figure 3: NO\textsubscript{x} produced by B20 with and without EGR](image)

The figure 3: shows the reduction in amount of NO\textsubscript{x} produced engine for B20 with and without EGR. By incorporating 10% of EGR we can reduce up to 7% - 8% of NO\textsubscript{x} produced engine for the same fuel.

**Conclusion:** Corn based biodiesel is not the entire solution to our transportation fuel needs. But it is clearly a key component overall goal of goal of energy independence. Corn biodiesel will continue to play a leading role in emerging bio economy.

**Future scope:** Soon biodiesel will become the new source of power. Through research and constant testing, biodiesel is more productive than the petroleum based fuel. It has been discovered that this type of product will become the new source of power. Not only for diesel automobiles but for other power sources individuals desperately require living and surviving. Before long, this type of supply will be not only in vehicles but also in homes and factories.