EFFECT OF INJECTION TIMING IN PERFORMANCE AND EMMISION CHARACTERISTICS OF A DI DIESEL ENGINE FUELLED WITH BIO DIESEL AND ITS BLENDS

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Abstract: *This paper deals with the experimental evaluation the effect of injection timing on the nitrogen oxide emissions for diesel engine fuelled with 20% blend of biodiesel with diesel (B20), as is likely to be widely used in the near future. Tests are conducted on a DI engine for different values of injection timing. The emissions of NOx are measured using 5-gas exhaust gas analyzer. The brake specific fuel consumption is also evaluated. Thus this work aims to arrive at the value of injection timing at which reduction in NOx is achieved without any major reduction in performance.*

Key Words: *Performance; Emmision; Diesel Engine ; Bio Diesel.*

1. INTRODUCTION:

In C.I engines the injection of fuel into the cylinder occurs just before combustion starts and that non-uniform burned gas temperature and composition result from this non-uniform fuel distribution during combination. During the "premixed" or uncontrolled diesel combustion phase immediately following the ignition delay, fuel-air mixture with a spread in combustion about stoichiometric burns due to spontaneous ignition and flame propagation . During mixing controlled combustion phase, the burning mixture is likely to be closer to stoichiometric. However, through ought the combustion process mixing between already burnt gases, air, and lean and rich unburned fuel vapor-air mixture occurs, changing the composition of any gas elements that burned at a particular equivalence ratio. In addition to these composition changes due to mixing, temperature changes due to compression and expansion occur as the cylinder pressure rises and falls.

It is found the maximum NO is formed at $0.85< Ø <1.1$. The critical time period is when burned gas temperatures is maximum; i.e., between the start of combustion and shortly after the occurrence of peak cylinder pressure Mixture which burns early in the combustion process is especially important since it is compressed to a higher temperature, increasing the NO formation rate, as combustion proceeds and cylinder pressure increases. After the time of peak pressure, burned gas temperature due to expansion and due to mixing of high temperature gas with air or cooler burned gas freezes the NO chemistry. This second effect means that freezing occurs more rapidly in diesel than in spark-ignition engine. As the local burned gas equivalence ratio becomes leaner due to mixing with excess air, NO concentration decrease since formation becomes much slower as dilution occurs.
Results show that almost all of the NO forms within the 20" following the start of combustion. As injection timing is retarded, so the combustion process is retarded; NO formation occur later, and concentrations lower since peak temperatures are lower. Thus EGR (Exhaust Gas Recirculation) aims at retarding the injection timing and thereby reducing the NOx.

2. EXPERIMENTAL PROCEDURE:

The instruments are calibrated according to the suppliers' instructions before conducting the engine tests. The engine is started and after warming up, tests are conducted at various loads with diesel followed by biodiel and their blends. At each load, the engine is operated for 15 minutes to stabilize under the new condition. For every fuel change, the fuel lines are completely cleaned, and the engine is allowed to operate for at least 30 minutes under this condition**.** Now the various parameters like engine speed and exhaust gas temperature from the digital tachometer, time taken for 10cc of diesel consumption from the burette arrangement, composition off the exhaust gas from the Exhaust Gas Analyzer and soot emission values from the smoke meter are noted.The above steps were repeated for 25%, 50%, 75% load and for full load conditions.

Different fuel blends of the palm oil, pungam oil, waste cooking oil and diesel were used to test the engine and its emissions. They were used as test fuels to run the engine at different load conditions and all the above-specified parameters were recorded.

The test was conducted for three injection timings

- 23.4º BTDC
- 18.4º BTDC
- 20.4º BTDC

The injection timing was varied by placing the Sims on the seat of the fuel injection pump.

3. RESULTS AND DISCUSSION:

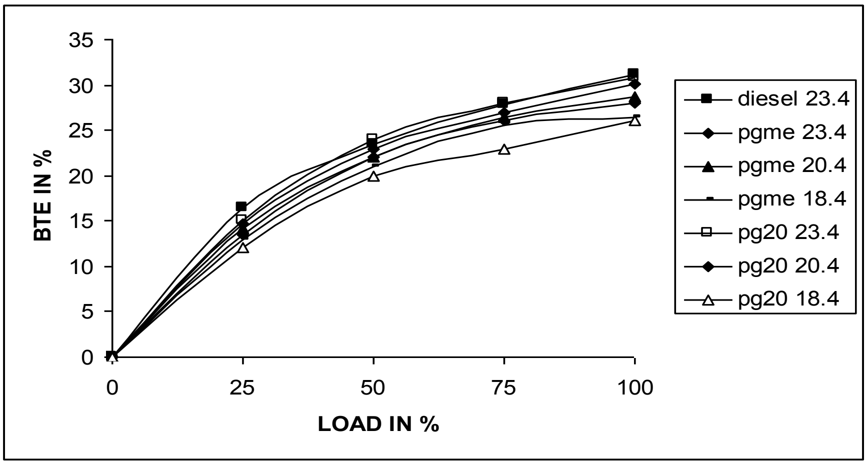

Fig .1 BTE VS % OF LOAD FOR PUNGAM AND ITS BLEND

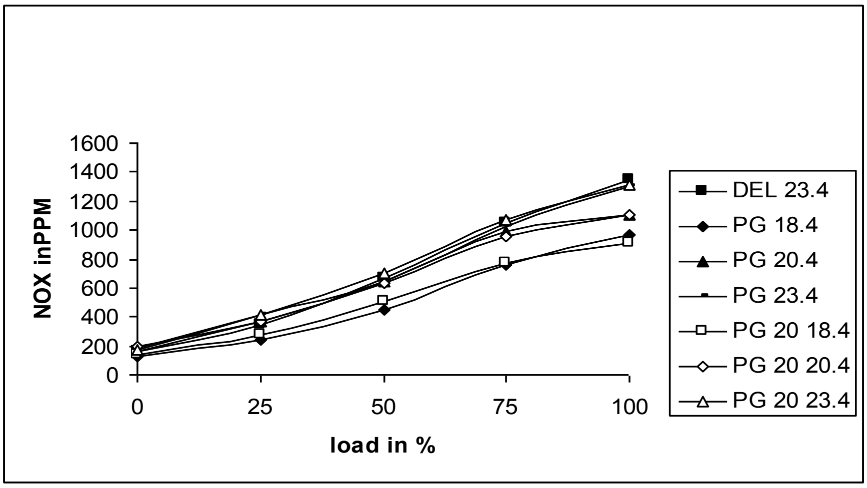

Fig.2 NOx VS % OF Load For Pungam Oil and its Blend

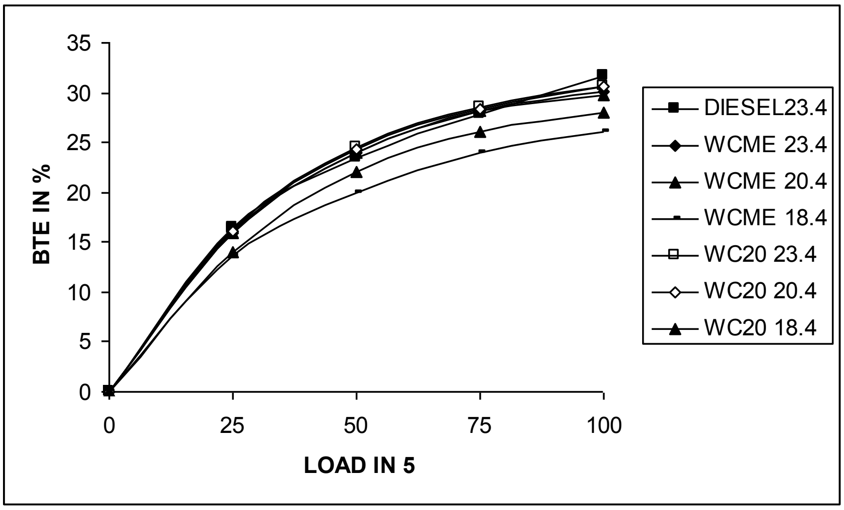

Fig .3 BTE VS % OF LOAD FOR WCME AND ITS BLEND

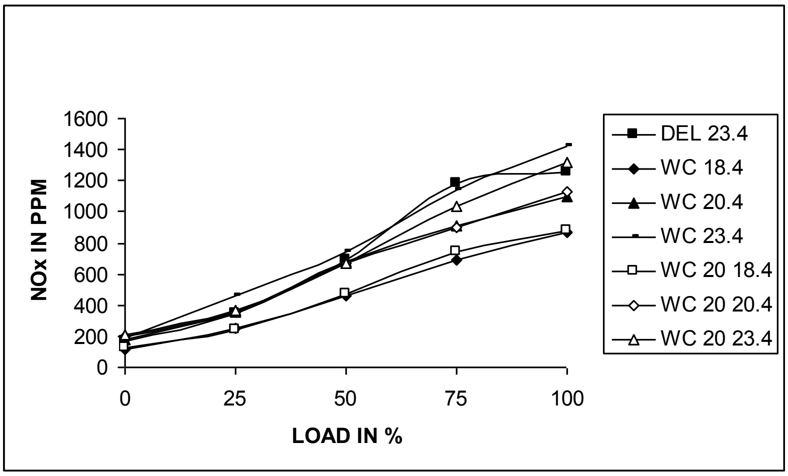

Fig.4 NOx VS % OF LOAD FOR WCME AN ITS BLEND

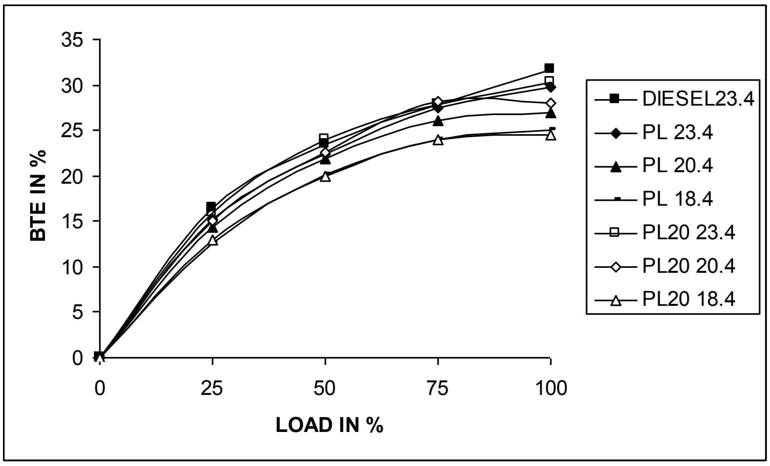

Fig.5 BTE VS % OF LOAD FOR PALM OIL AND ITS BLEND

4. CONCLUSION:

It is clear from the above results that brake thermal efficiency decreases with retardation of injection timing for all selected fuels. It is noted that brake thermal efficiency reduces from 2-4% at 18.4°btdc compared to the efficiencies at 23.4°btdc, whereas when the timing is set at 20.4 it only reduces negligibly.

It is evident from the graphs that NOx emissions reduces with retardation of injection timing . NOx emissions at 18.4°btdc reduce considerably compared to the emissions at 23.4°btdc. NOx emissions at 20.4°btdc also reduces compared to the emissions at 23.4°btdc.

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