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An assessment of the Performance and Exhaust air quality of DI-CI Engine Energized with Nano fluid

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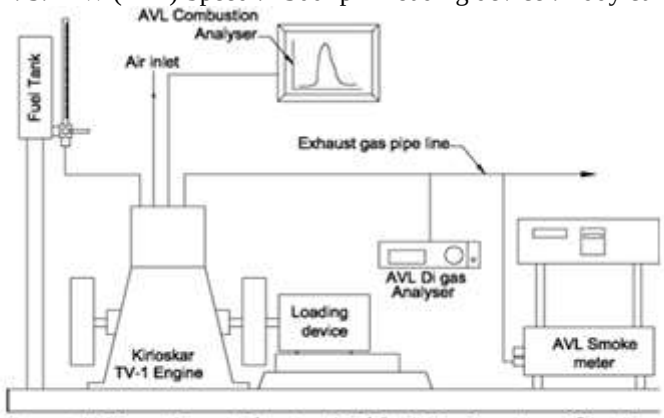
Abstract : This study has been undertaken to investigate the determinants of stock returns in Karachi Stock Exchange (KSE) using two assets pricing models the classical Capital Asset Pricing Model and Arbitrage Pricing Theory model. To test the CAPM market return is used and macroeconomic variables are used to test the APT. The macroeconomic variables include inflation, oil prices, interest rate and exchange rate. For the very purpose monthly time series data has been arranged from Jan 2010 to Dec 2014. The analytical framework contains.

Keywords- Iron oxide; DI-CI Engine; Emission; Nano Fluid; Ultrasonicator.

I. INTRODUCTION It is known nearly to each inhabitant of the planet earth that non-renewable energy source assets are draining step by step and henceforth, there is a need to scan for sources of power to full the developing vitality requests of the world [1]. All the more significantly, the natural emergencies brought about by huge ignition of petroleum derivatives have driven towards finding the systems to address the fundament degree of air contamination and its possibly terrible results e.g., environmental change [2]. Among the different elective powers, bio powers (specifically fluid bio energizes e.g., bio ethanol, bio buthanol and biodiesel), have gotten a lot of consideration as the most attractive fuel extenders for the transportation part [3]. This is credited to the way that these vitality transporters are fit for controlling machines without exhaust emissions, for example, SO, HC, and CO are extensively less in correlation with those of the non-renewable energy sources [4-6]. Based on various experiments directed before, it was discovered that the biodiesel fuelled diesel engine transmit less carbon monoxide, hydrocarbon, and particulate issue (PM) when contrasted with diesel however there is a slight increase in Oxides of Nitrogen (NOX) in output results [7]. Decreasing of NOx can be accomplished while utilizing biodiesel can be accomplished by improving the diesel engine structure and combustion chamber. In any case, the decrease rates accomplished have not been satisfactory to satisfy the output results. Further decrease in emission and improvement in efficiency can be accomplished by utilization of nano additive fuel substances. Metal based additives have been utilized for combustion initiations to elevate the burning and to decrease fuel consumption and emanations for hydrocarbon emission. These metal based added substances incorporate cerium (Ce), iron oxide (FeO), platinum–cerium (Pt–Ce), iron (Fe), manganese (Mn), barium, calcium and copper [8]. The decrease of emanation while utilizing metal based additive substance might be either because of the way that the metals respond with water fume to create hydroxyl radicals or fill in as an oxidation impetus accordingly diminishing the oxidation temperature that results in increasing the rate of combustion [9–11].

II. EXPERIMENTAL INVESTIGATION Preparation of Nano Additive Blends with Diesel The nano fluid was prepared with sole diesel by mixing the iron oxide with the help of an ultrasonicator. The ultrasonication is the suitable method to spread the nano additive in the base fuel. There is possible of aggleromation in particles of nano additive in nanometer range. The nano additive are weighed say 10ppm and dispersed in the diesel with the help of ultrasonicator set at a frequency of 20 kHz for 15-40 minutes. The resulting nano additive diesel is named as DIO 10ppm. The same procedure is carried out for the mass fraction of 20ppm, 30ppm, 40ppm, 50ppm, 60ppm and 70ppm to prepare the Iron Oxide nano additive in diesel fuel. Experimental Procedure The test carried out on diesel with iron oxide nano additive blends was carried out in DI-CI engine. The engine used for experimentation is a single cylinder, DI, water cooled Compression Ignition engine. The experimental arrangement is shown in figure A. Diesel engine was coupled directly with an eddy current dynamometer. The engine operated with a maximum speed of 1500rpm. The speed of the engine was controlled by a governor. The control panel is used to interfacing of dynamometer for optimum control. Experimental work carried out to evaluate the performance and emission characteristics of a DI-CI Engine fuelled with iron oxide nano additive blends in a different combinations of 10ppm, 20ppm, 30ppm, 40ppm, 50ppm, 60ppm, 70ppm and diesel at various load conditions. The exhaust pollutions like
NOx, CO and HC are measured with the help of gas analyzer and smoke meter was used to evaluate smoke density. The engine specifications are mention in table 1. Figure 1. Experimental setup Table.1.Engine Specifications Type : Single cylinder vertical

water cooled, 4 stroke Diesel Engine Bore : 87.5 mm Stroke : 110 mm Cylinder diameter : 0.0875 m Stroke length : 0.1m Compression ratio : 17.5 : 1 Power : 5.2 kW (7HP) Speed : 1500 rpm Loading device : Eddy current dynamometer



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III. RESULT AND DISCUSSION

Performance Characteristics The specific fuel consumption results that the using of different nano fluid blends are given in Fig. 2. The specific fuel consumption decreases when increasing the engine loads. The 60ppm blends of nano additives have lower specific fuel consumption when compared with other nano additive blends in all load range. The specific fuel consumption of 60ppm iron oxide nano additive is almost same as diesel fuel at all loads. This is due to the enhancement of surface area to volume ratio by the catalytic effect of during the combustion inside the engine cylinder.

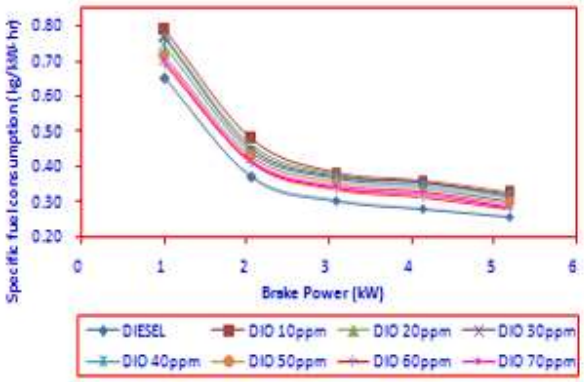

Figure 2 Specific fuel consumption Vs Brake power

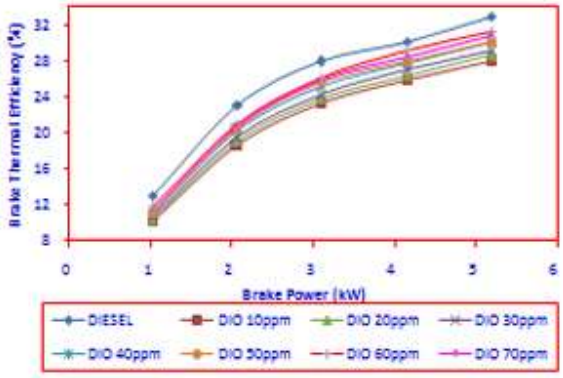

Figure 3 Brake thermal efficiency Vs Brake power

The outputs of engine Brake thermal efficiency using various blends of iron oxide nano additive are shown in Fig. 3. By adding the iron oxide nano additive there is an improvement in thermal efficiency compare to diesel operation at full load. There is a noticeable improvement in Brake thermal efficiency by adding nano additive at full load. Because metal oxides reduces the evaporation span of the fuel and relatively it reduces the physical delay during combustion. The iron oxide nano additives used in the system have lower the brake thermal efficiency when compared with diesel. However, improvement in brake thermal efficiency was recorded for 60ppm as 31.28% closer to diesel value.

Emission Characteristics The output results of smoke values are presented in Fig.4. It is observed that the exhaust smoke emission was reduced using nano additives. The oxygen availability in the nano additive acts as better combustion and reduces the smoke emission. With the dispersion of iron oxide the smoke is decreased the fuel added with 60ppm given the lowest smoke emission varies from 24.2 HSU at low load to 55.3 HSU. The values oxides of nitrogen (NOx) emissions with brake power for sole diesel fuel and nano additive blends shown in Fig. 5. NOx emissions increases with elevation of brake power for all blended fuel. The NOx emission lowered for the blends when comparing to increasing of nano diesel blends. Nano Metal additives enhance the reaction causes for higher combustion temperature and later on higher NOx emission. However NOx are substantially reduced with the incorporation of metal nano additive. Thermally elevates the reaction with oxygen and hydrocarbon tends to

reduction of oxides of nitrogen. It was observed that the nano additive in diesel helps to reduce the NOx emission. blended fuel. The NOx emission lowered for the blends when comparing to increasing of nano diesel blends. Nano Metal additives enhance the reaction causes for higher combustion temperature and later on higher NOx emission. However NOx are substantially reduced with the incorporation of metal nano additive. Thermally elevates the reaction with oxygen and hydrocarbon tends to reduction of oxides of nitrogen. It was observed that the nano additive in diesel helps to reduce the NOx emission.

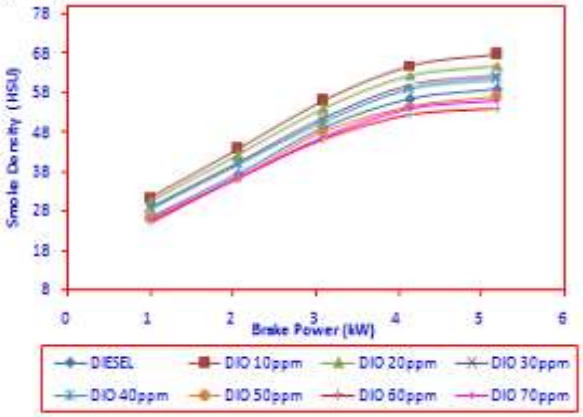

Figure 4 Smoke density Vs Brake power

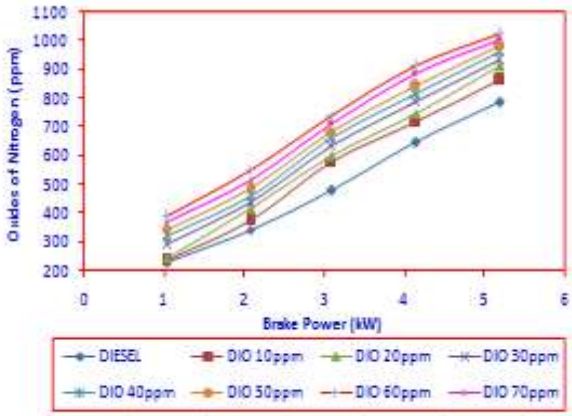

Figure 5 Oxides of nitrogen Vs Brake Power

Fig. 6 shows that the outcome of the nano additive on hydrocarbon emissions. The measures of HC emission for the nano diesel including 60pmm of iron oxide is lower compared to that of neat diesel. This would be nearly due to shorter ignition delay period and enhanced ignition characteristics of iron oxide nano additive diesel blend.

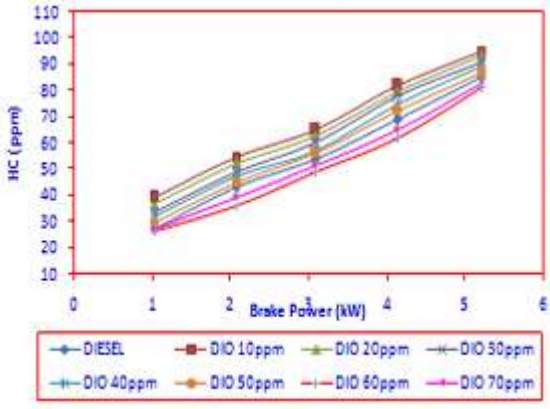

Figure 6 Hydrocarbon Vs Brake power

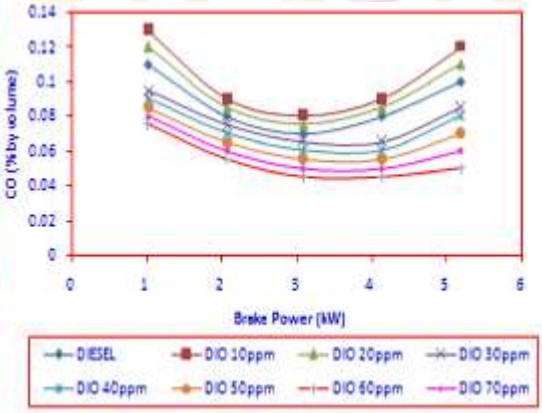

Figure 7 Carbon monoxide Vs Brake power

The results of carbon monoxide (CO) with brake power showed in Fig. 7 for nano additive blended diesel fuels. It was observed that the emissions CO increased relatively increasing in brake power for all blends. Also the addition of nano additive increases CO emission. Nano additive have disturb flame reduces ignition delay timing, which leads to more complete combustion propagation inside the combustion chamber. This characteristics is due to the results of iron oxide causes increase in reduction of the ignition delays period, which related to more complete combustion. The iron oxide nano additive acts as an oxygen donor catalyst and it provides more oxygen for the combustion of HC and CO absorbs more oxygen for the reduction of NOx. Fig.8 shows the exhaust gas temperature for varying brake power and corresponding nano additives. At higher loads, nano additive blends exhibit less exhaust temperature than diesel. However 40ppm shows lesser Exhaust gas temperature as compared to other blends due to its lower heating value and the improved oxygen content provided by the blends which increases better combustion. This can be explained by the fact that there is effective combustion taking place and minimum energy loss within the exhaust.

The results of Exhaust gas temperature with various nano additive diesel blends are shown in Fig.8. It was observed that different nano additive blends are having less exhaust temperature than the diesel values at maximum load conditions. However 60ppm exhibits lower Exhaust gas temperature when compared to other nano fluid blends because of its lower temperature value and the increasing oxygen content absorbed from the blends which increases rate of combustion. This will happen due to better

combustion rate takes place and there is lower energy loss send through the exhaust.

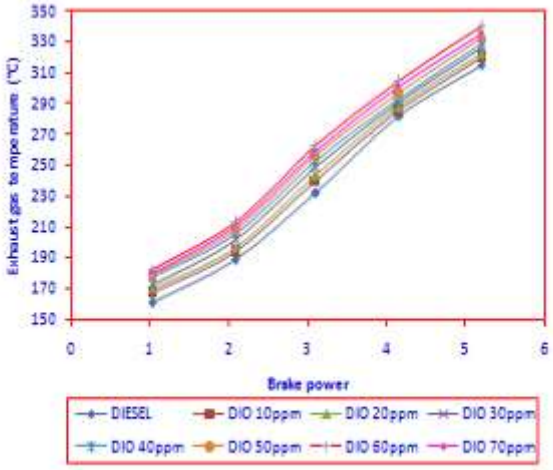

Figure 8 Exhaust gas temperature Vs Brake power

IV. CONCLUSION The nano additive blended fluid stability characteristics and the reactivity rate during addition of nano additive on engine performance and exhaust emissions were investigated.

- From the study of the experimental work, the following conclusions are exhibited. The specific fuel consumption enhancement with increase in value of nano additive blends due to lower calorific.
- The brake thermal efficiency in 60 ppm iron oxide blend is closer to the neat diesel.¬ Particulate matter and Smoke density is lower in 60ppm iron oxide nano additive blend compared to pure diesel at all¬ load condition.
- Lower NOx value obtained in all nano additive blends than diesel.¬ HC and CO is lower in blends with lesser nano additive.¬

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