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Effect of initial fuel temperature of diesel fuel on the noise emissions from compression ignition engine

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ABSTRACT

The present work deals with the effect of the initial fuel temperature on the noise of compression ignition engine. The engine noise was observed by examining the noise emitted from the engine for different values of cetane number (53, 54 ,56), to find out what sample of cetane number is affected by a significantly more than the others, The experimental results showed that the fuel of cetane number (56) it is the lowest noise emission , and the isolation material reduce the noise emission about (5dBA).
Key Words:- Noise, Cetane number,Fuel consumption, brake specific fuel consumptions, emissions.

1.INTRODUCTION

Sound is caused by pressure waves in an elastic medium (air) generated by vibrations of the engine components, These vibrations cause pressure pulses in the air, and these pulses transfer energy to the human ear, the greater the energy , the louder is the sound These vibrations cause pressure pulses in the air, and these pulses transfer energy to the human ear, the greater the energy , the louder is the sound Fortunately the ear is not very sensitive, and so the quantifying scale is a logarithmic scale with units of decibels (dB), Normal conversation has a sound level of about (55 dB) , while the ear begins to feel pain at about (120 dB) , Many engine room codes allow noise up to (110 dB) , the sensitivity of the human ear is closely related the sound frequency , being less sensitive at low frequency for this reason , international standards are divided into three categories - A,B and C – each related to range of frequencies. In the united states the (EPA) has an acceptable level of drive – by noise for vehicles of (74 dB(A)) . this standard often must be considered in automobile design in areas such as tailpipe and muffler placement[1].

1.1Noise pollution

Since the 1990s , noise generated by engines and other systems has been considered a pollution, Noise is sometimes defined as a possible health hazard , large engines produce high levels of sound , and many countries now have laws governing acceptable levels of noise allowed in closed engine rooms of ships and in stationary applications[2].

1.1.1Sound pressure Level.

The range of sound pressure generated by common noise sources is also very large and, as in the case of sound power levels, pressure level calculations are expressed in logarithmic form, This happens to be expedient because the ear responds to stimulus logarithmically and not linearly, This happens to be expedient because the ear responds to stimulus logarithmically and not linearly, Also , it responds to intensity of sound (which is proportional to P) rather than pressure alone, The lowest sound intensity detectable by the normal ear is about (10-12) watt/m2, this equates to a pressure of (2 * 10(-5)) N/m2 . this value has been standardized , as the reference pressure for sound level calculations[3].

$$SPL = 20\log(p/pr) \qquad (1\text{-}3)$$

Where p : is the measured pressure.

pr : is the reference pressure (2 * 10(-5) N/m2).

1.1.3The effect of acoustical isolation and engine noise reduction

DR.H.A.shahad,DR.R.K.yousif and A.J.sabieh,[4],1993,the study the diesel engine faults by using noise measurement technique, this study was aimed at measuring the noise emitted from small high speed diesel engine at different operating conditions also it was aimed at using noise measurement as a diagnostic technique for fault finding the result show that it is possible to use the noise diagnostic technique to study engine faults and its problems.

kanterlies and Walker studying,[5],1986, the study was made in Southampton university in united kingdom, it was studying noise effect from diesel engine muffler and its effect on human disturbance and the range of change in sound nature that caused increase in disturbance that is generating from it, the two researcher was observed that the noise that causing disturbance its causing from increase in engines speed and the noise was reduced between the range (5-8 dbA).

Staiano studying,[6],1982, the study was done by a suggestion from the environmental protection agency (EPA) to explain the effect of generating noise from the automobiles on the environment and the effect of maintenance on reducing it, also this study was focused on measuring the sound pressure level for automobiles before and after the maintenance the measuring for muffler system was done on stoped cars and for different engine speeds, the researcher conclusion was that the measuring that taken to sound pressure level after maintenance at outlet pipe for the muffler system its level reduced at a range from (3-6 dbA).

Maher.A.R.Sadiq,Yasser.K.Ali and Aimen Rashad Noor,[7],2010, the study the effects of ethanol-gasoline blends on exhaust and noise emissions from 4 stroke S.I.engine , the experimental test started with pure gasoline, and its considered as a data base level for comparison purposes gasoline fuel was mixed with different percentages of ethanol (99.9%) purity various blend ratios of ethanol-gasoline fuels (20,40,60,80,100) have been prepared, the engine noise level was studied at various blend ratios of ethanol gasoline fuels with different engine loads, it is noted that the noise level emissions depends on the engine operating condition rather than ethanol content also it is seen that there is a slightly increase in the total noise level with the increase in engine load and ethanol content.

C.M.P.Chan, I.D.Moncrieff, R.A.Pettit,[8],1982, they determine the combustion noise of a diesel engine using the relationship between the cetane number of diesel fuel and the combustion noise, the test was done on perkins (3.86 L) diesel engine, the combustion induced mechanical noise of an engine with different fuel cetane number was also investigated, the combustion noise obtained with various alternative fuels including vegetable oils, also documented the difference in the fuel parameter and the associated combustion noise are discussed.

DR.Adel Mahmood Salih and Hussain Ali Ahmed,[9],2012, they study the effect of methanol alcohol addition on performance and emitted noise from single cylinder spark ignition engine, in this research a scientific study has been proceeded to illsturate the impact of adding methanol-alcohol of (10%) and (20%) by volume of gasoline without lead with (81) octane number on performance and noise emitted from single cylinder internal combustion engine work by ignition with compression ratio (9.5), the result show that the addition of (10%) methanol can increase the brake power about (22%) while the addition of (20%) methanol reduce the brake power about (8%) after a comparison with the performance of the engine without addition for the fuel consumption the study show that the rate of consumption increases (1.8%),(30%) with the addition of (10%) and (20%) methanol alcohol , the noise rate result showed that reducing of (OASPL) about (3.3%) with use the addition of (10%) methanol, while addition of (20%) methanol causes increasing in (OASPL) about (1.2%), after a comparison with the performance of engine without addition also the experiments have been preceeded with three stages to illsturate the impact of the sonic isolator (crok isolator 2.5cm) thickness and glass isolator (4mm) thickness, the result show that reducing of (OASPL) about (5 dbA) with crok and (8 dbA) with using two isolation.

2.EXPERIMENTAL WORK

The experimental work was performed in the internal combustion engine laboratory of the mechanical engineering department – university of technology. The engine used in the experimental work is compression ignition engine (CI engine) *Fiat* , 4-stroke, 4 cylinders. The displacement volume for this engine is 3.666 liters. The engine was coupled to a hydraulic dynamometer to measure the brake torque. Figure (1) shows the experimental rig of the engine.

Figure (1), C.I. engine experimental rig

The measuring of the engine speed of compression ignition engine was carried out by using analogue tachometer type . See figure (3).

Fig (3), Tachometer type (VDO)

2.1Experimental procedure.
The following steps were done to implement the experimental work:

1. Preparing the engine and the measurement devices to read the data for (1100,1300,1500,1700,1900,2100,2300,2500) rpm.
2. Measuring engine speed, brake torque, the pressure differential between the atmosphere and pressure inside the air box, and time of fuel consumed for volume of (100) ml.

3-preparing the types of fuel of different fuel cetane number of (56,54,53).
4- preparing the noise level meter type (CS 171A) to measure the noise level.
5- preparing the isolation material of crok material two pieces wall thickness (2.5cm).

3.RESULT AND DISCUSSION

The experimental results were obtained by testing the noise emitted from the diesel engine.

3.1 noise emissions and the effect of the isolation material on noise levels for different fuel cetane numbers.

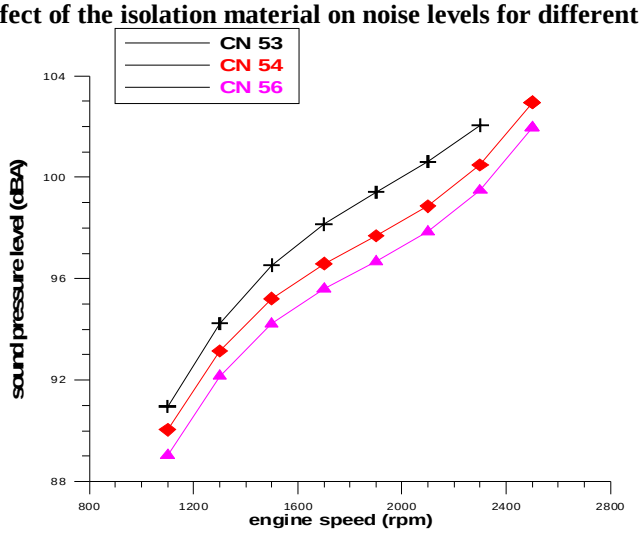
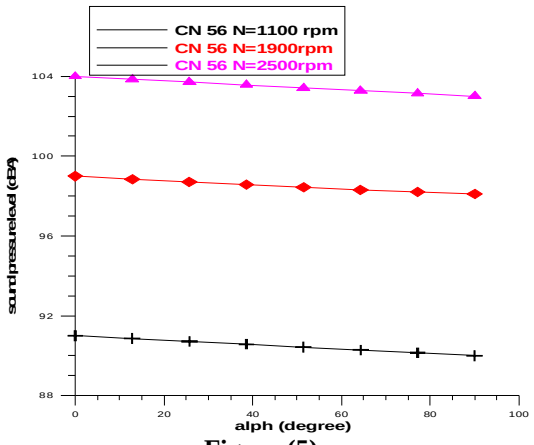


Figure (4).



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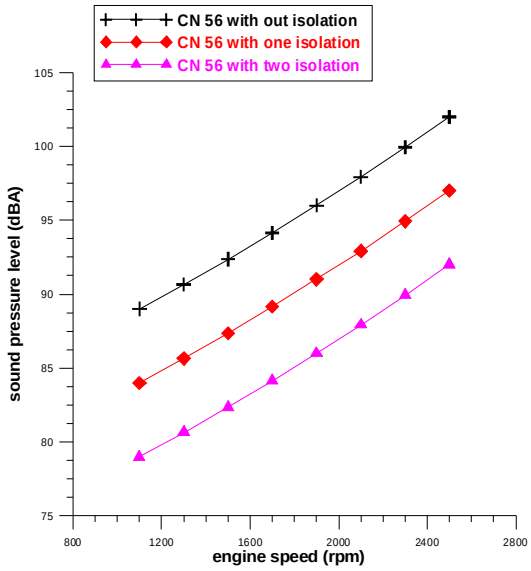

Figure (6).

4.CONCLUSION

1. From Fig (4) showing that the noise level of the engine is increase with engine speed and its showing that the fuel with high cetane number has the lowest noise level.
2. From fig (5) showing the directivity of the noise around the engine for different angle (0,45,90) and found that the sound level value is too small so the source is monopole source.
3. From fig (6) showing the effect of the isolation material which reduce the noise value about (5dBA) for one isolation and (10dBA) for two isolation.

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