STUDIES ON EMISSION CHARACTERISTICS OF CI ENGINE USING DIFFERENT BIO-DIESEL BLENDS

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Abstract –

The operation of IC engines effects in the emission of hydrocarbons, carbon monoxide (CO), nitrogen oxides (NOx), Smoke opacity (SO), Carbon dioxide (CO_2) and Unburnt hydrocarbons (HC) The actual concentration of those criteria pollution varies from engine to engine, mode of operation, and is strongly associated with the type of fuel used. An emission control machine, in vehicles, means hired to restrict the discharge of noxious gases from the inner combustion engine and other components. The exhaust pipe discharges burned and unburned hydrocarbons, carbon monoxide, oxides of nitrogen.

Index Terms - Carbon monoxide, Nitrogen oxide, Smoke opacity, Unburnt hydrocarbon, IC Engine

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1. Introduction

To meet stringent emission standards, it is very important to know the causes of the types of emissions emitted by CI engines and effective control techniques for diesel, biodiesel CI engines. The main sources of emissions are the separation of non-sticky trick-burning nitrogen and impurities/changes in fuel and air, the last two being very important. The separation of nitrogen is due to nitrogen molecules present in the atmosphere (fresh air) and fuel. Dissociation occurs at high temperatures in the combustion chamber. NOx Formation Mechanisms The following subheadings describe the dynamics of NOx formation. Impurities in fuel, air and their mixtures increase particulate matter. Also, a constant change in the ratio of fuel to air induces acting. The CI engine is well known in high power and efficiency applications, but its use is limited by higher emissions. Emissions are a combustion by-product of hydrocarbon fuels in the presence of oxygen. Additional oxygen fuels such as biodiesel help overcome emissions as well as alternative fuels to diesel (fossil) fuels. Carbon monoxide (CO), hydrocarbons (HC) is produced in exhaust gases as a result of incomplete combustion of fuels. Most of the exhaust hydrocarbons come from engine lubricants. When the engine is operated in an enclosed space such as a building, tunnel, warehouse, etc. under underground mine construction, carbon monoxide can accumulate in the surrounding atmosphere, causing headaches, dizziness, and fatigue. Under the same conditions, hydrocarbons cause eye irritation or choking. Hydrocarbons and aldehydes are the main contributors to the characteristic diesel odor. Hydrocarbons also have a negative environmental impact, which is an important component of smog. Nitrogen oxides (NOx) are produced from nitrogen and oxygen under high and high temperature conditions in engine cylinders. NOx is mostly composed of nitric oxide (NO) and a small amount of nitrogen dioxide (NO_2). Nitrogen dioxide is very toxic. NOx emissions are also a serious environmental problem due to the role of smog formation. Alcohol combines with triglycerides to form an ester with glycerol. The reaction is reversible and requires extra alcohol to move the equilibrium towards the product.

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Among the alcohols that can be used in the transesterification process are methanol, ethanol, propanol, butanol, and amyl alcohol. The transesterification reaction gets a sharp change in the viscosity of vegetable oils. The biodiesel produced by this process can be completely mixed with mineral diesel in any proportion.

2.0 Materials and Methodology

2.1 Emission Parameters:

Diesel and biodiesel mixture emissions are measured on a volume basis. It means the amount of% Vol or ppm. Here, unburned hydrocarbons (UHC or HC (ppm)), carbon monoxide (CO (% Vol)), nitric oxide (NO (% Vol)), carbon dioxide (CO_2 (% Vol)), oxygen (Includes O_2 (%)) and smoke (% opacity). The emissions of different biodiesel mixed hybrid mixes. This figure describes the opacity of CO, HC, NO, CO_2, and smoke.

Emission Characteristics of hybrid biodiesel blends and diesel

The experiment is conducted using diesel, jatropha , Karanja and waste cooking oil biodiesel , emission characteristics such as Carbon –monoxide, Carbon-dioxide, Unburnt hydrocarbons, Oxides of nitrogen and Smoke

3.1 carbon-monoxide

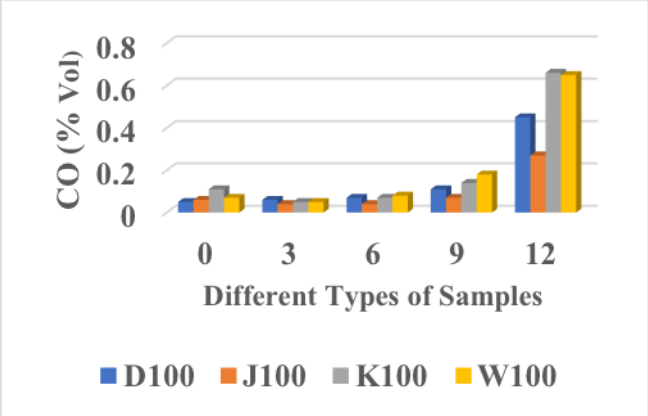

Fig 1: carbon-monoxide emissions for different samples at different load conditions

The figure 1 shows that carbon monoxide emissions for J100 sample are greatly reduced compared to diesel at 12kg max load. Since biodiesel contain oxygen in itself, it improves combustion of biodiesel which result in decline of Carbon monoxide emission.

3.2 carbon-dioxide

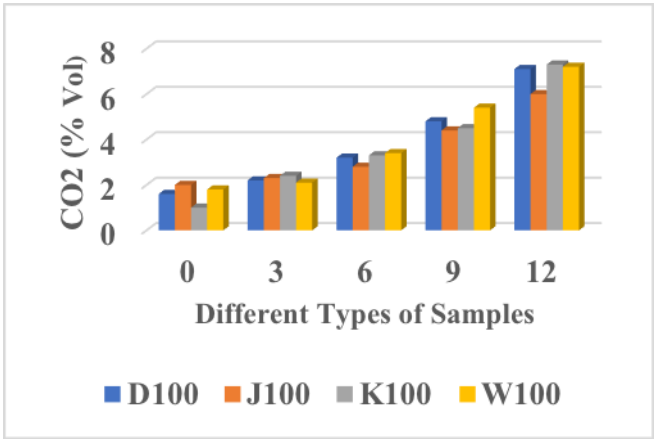

Fig 2 carbon-dioxide emissions of different samples at different load conditions

The variation of carbon-dioxide emissions with respect to different samples at different load conditions is shown in figure 2. The carbon dioxide emission for J100 sample is low and K100 sample is high compared to diesel at 12kg max load. It is observed that the amount of carbon-dioxide produced while using J100 sample is lower than diesel, this is be due to the late burning of fuel leading to incomplete oxidation of Carbon monoxide. The more amount of carbon-dioxide is the indication of complete combustion of fuel in the combustion chamber.

3.3 UBHC

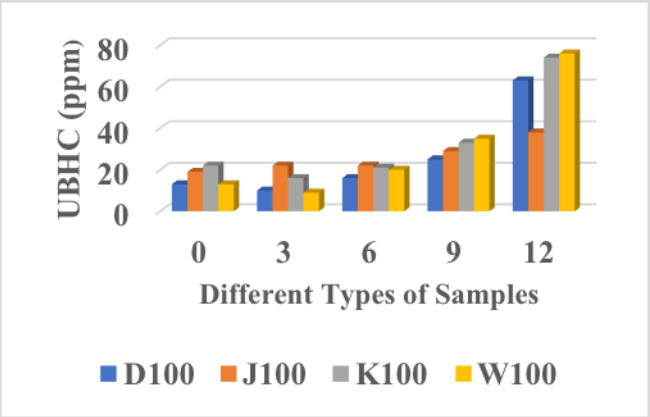

Fig 3:unburnt hydrocarbon emissions of different samples at different load conditions

Fig 3 shows variation of Unburnt hydrocarbons for different samples at different load conditions. The J100 sample shows lower value and W100 sample shows higher value of unburnt hydrocarbon emissions compared to diesel. UBHC is a strong function of air-fuel ratio. At near stoichiometric fuel-air mixtures both hydrocarbons and carbon- monoxide (HC/CO) emissions are higher and lean fuel mixtures have substantially low (HC/CO) emissions.

3.4Oxides of Nitrogen (NO_X)

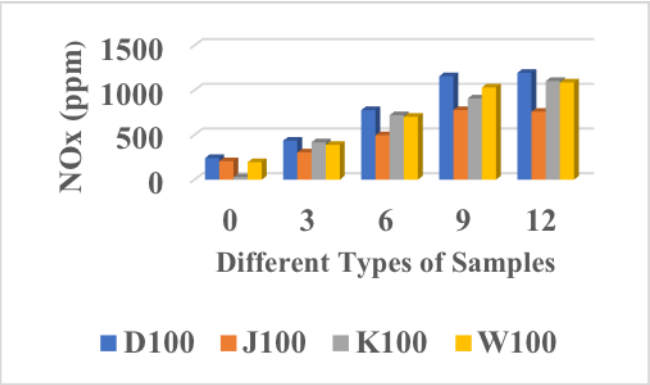

Fig 4 oxides of nitrogen emissions of different samples at different load conditions

Figure 4.13 shows the variation of NOx emission for different samples at different load conditions. The NOx value is higher for D100 sample and lower for J100 sample at 12kg max load. The NOx are the combination of nitric oxide (NO) and nitrogen dioxide (NO_2).Nitrogen and oxygen react at relatively high temperature. Therefore, high temperature and availability of oxygen are the two main reasons for formation of NOx. when the proper amount of oxygen is available, the higher the peak combustion temperature the more is the NOx formed.

3.5 Smoke

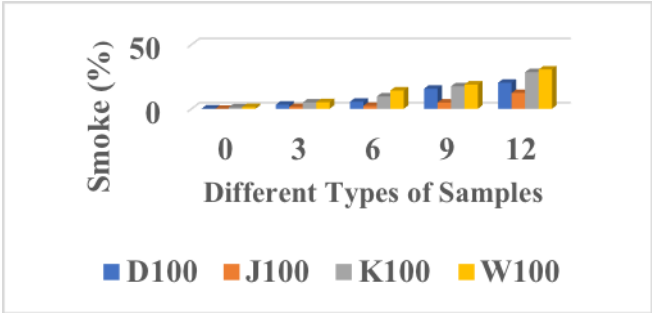

Fig 5 smoke emissions for different samples at different load conditions

The figure 5 shows variation of smoke emission for different samples at different load conditions. Smoke of the engine exhaust is a visible indicator of the combustion process in the engine, smoke is due to the incomplete combustion. The W100 sample is showing high value and the J100 sample is showing low value of smoke emission compared to diesel at 12kg max load. Higher viscosity value of W100 sample is the reason for higher level of smoke emission compared to diesel .Higher viscosity of the fuel results in poor atomisation and poor spray pattern .

3.6 Emission Characteristics of Hybrid Biodiesel Blends and Diesel

Samples	Load	(CO, % Vol)	(CO2, % Vol)	(UBHC, ppm)	(NOX, ppm)	Smoke (%)
J10K10D80	0	0.03	1.00	7	99	19.25
	3	0.04	2.00	10	299	17.77
	6	0.03	2.10	13	414	17.61
	9	0.04	2.50	12	454	17.09
	12	0.26	4.30	35	558	14.37
J20K20D60	0	0.03	1.60	9	206	18.50
	3	0.03	1.90	8	293	18.11
	6	0.04	3.30	15	744	15.95
	9	0.06	4.40	23	879	14.46
	12	0.29	6.30	47	874	11.84
K10W10D80	0	0.05	1.70	6	197	18.30
	3	0.07	3.10	16	605	16.25
	6	0.08	3.40	18	729	15.95
	9	0.14	5.70	32	1180	12.74
	12	0.42	6.10	59	969	12.03
K20W20D60	0	0.06	1.90	7	235	18.02
	3	0.05	2.50	9	452	17.19
	6	0.10	4.0	19	921	15.04
	9	0.12	5.20	27	1078	13.49
	12	0.49	6.90	61	1088	10.99
J10W10D80	0	0.04	1.50	11	174	18.49
	3	0.04	2.90	18	469	16.53
	6	0.05	4.00	25	876	14.99
	9	0.06	5.00	28	1010	13.68
	12	0.32	7.30	56	1016	10.42
J20W20D80	0	0.03	1.40	10	172	18.73
	3	0.04	2.60	14	424	16.86
	6	0.04	3.10	23	763	16.13
	9	0.05	4.70	22	920	14.22
	12	0.23	6.80	44	973	11.33

we can observe that CO, CO_2, UBHC, NO_X and smoke emission values are low for the samples J20W20D60, J10K10D80, J10K10D80, J10K10D80, J20W20D60 respectively compared to diesel at 12kg max load. Hence, J10K10D80 sample is considered as optimum blend.

4.Comclusions

carbon monoxide emissions value is high for K20W20D60 sample and low for J20W20D80 sample at 12kg max load. Poor air-fuel mixing and incomplete combustion is the source for CO emission. Biodiesel itself has high oxygen content in it. This helps for the complete combustion. Hence, carbon monoxide emission decreases with increasing biodiesel percentage in the fuel.

Unburnt hydrocarbon emission of hybrid samples at different load conditions. Unburnt hydrocarbons are the direct result of incomplete combustion. The sample K20W20D60 shows high value and J10K10D80 shows low value of unburnt hydrocarbon emission at 12kg max load. With a fuel rich mixture there is no enough oxygen to react with all the carbon, resulting in high levels of HC and CO in exhaust products. we can observe that CO, CO_2, UBHC, NO_X and smoke emission values are low for the samples J20W20D60, J10K10D80, J10K10D80, J10K10D80, J20W20D60 respectively compared to diesel at 12kg max load. Hence, J10K10D80 sample is considered as optimum blend.

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