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EMISSION OF DIESEL ENGINE USING A MIXTURE OF WASTE COCONUT OIL AND SESAME OIL BIODIESEL BLENDS AND DIESEL FUEL

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I. ABSTRACT

Biodiesel fuel has been gaining increased attention from engine researchers in view of energy crisis and environmental pollution. The present work is based on the usage of waste coconut and sesame seed oil as an additive to diesel for biodiesel. The experiment was conducted on Kirloskar make single cylinder, four-stroke, water-cooled, vertical, direct injection, diesel engine used to carry out the emission test in the present research work. The biodiesel used is the blend of different ratio of diesel and additive. The exact volume ratio of mixing additive to diesel to obtain different blends of biodiesel is called blending. The biodiesel blends used in present work are B10, B20, B30, B40 and B50

II. INTRODUCTION

The world is facing oil crisis, due to the depletion of existing fossil fuel and environmental deterioration. Fossil fuels like diesel, petroleum and coal are playing an important role in the growth of industries which accelerates the quality of life. Extensive use of these fuels has indirectly effected and has given rise to environmental issues. The statisticians have predicted that the fossil fuel reserves will not last longer than twenty years. Petrol and diesel are the two fuels which are most largely in demand. Use of fossil fuels for the purpose of burning leads to the excessive emission of Carbon monoxide, Carbon dioxide and Oxides of Nitrogen along with particulate matters, which are the main sources of emission. Hence, the fossil fuels are responsible for pollutions and global warming; hence the usage of alternative fuels started instead of fossil fuels. Biodiesel is a derivative of clean burning fuels, produced from renewable resources. It does not contain petroleum but can be blended at any level with diesel. Biodiesel is used in diesel engine without any extensive modifications. Biodiesel is environmental friendly, in toxic and substantially free from Sulphur and its mixture. Mixing the biodiesel and diesel in a proper ratio is known as Blending, which can be done with the help of a flask and volume measurements. The exact quantity of oil and the diesel are mixed in a flask and in turn by constant stirring process, this secure proper mixing of biodiesel with diesel. The performance of any engine mainly depends on the viscosity, density of the fuel and the molecular oxygen. The lower mass based heating values of the vegetable oils requires higher mass of fuel flow to maintain constant energy input to the engine. The CI engine operated by petroleum products produce CO_2, CO, HC and the emissions which are toxic in nature affect human health.

III. EMISSION EFFECTS ON HUMAN BEING AND ENVIRONMENT

Green House Gases (CO_2): Motor vehicle also emits pollutants such as carbon-di-oxide that contribute to global climate change. In fact due t the emission of such global warming gases 30% of heats trapping gases are emitted which increases the temperature of earth surface and cause danger to the human race.
Carbon monoxide (CO): This odourless, colourless, and poisonous gas is formed by the combustion of fossil fuels such as gasoline and is emitted primarily from vehicles. When inhaled it blocks the oxygen from the brain, heart, and other virtua l organs.

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Hydrocarbons: These pollutants react with nitrogen oxides in the presence of sunlight and forms ozone at the ground level, a primary ingredient of smog. Though it is beneficial at upper atmosphere but at ground level it creates irritation in respiratory system, causing coughing, choking, and reduced lung capacity.

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Nitrogen oxides: These pollutants causing lung irritation and weaken the body's defences against respiratory infections such as pneumonia and influenza. It also assists in the formation of round level ozone and particulate matter.

Sulphur-di-oxide (SO_2): Power plants and motor vehicles create this pollutant by burning sulphur containing fuels especially diesel. Sulphur dioxide can react in atmosphere to form fine particles and poses the largest health risk to young children and asthmatics.

IV. AIR QUALITY IN INDIA

According to the WHO survey of 1600 cities in world, the Indian capital Delhi stands first place in most polluted city in India and followed by Mumbai, Gwalior, etc... Air pollution in India is estimated to kill 1.5L people every year. India has the world's highest death rate from "Chronic Respiratory Disease and Asthma", according to the WHO. A survey done in November 2016, the air pollution spiked far beyond acceptable level. The levels of PM2.5 and PM10 particulate matter hit 999micrograms per cubic meter of air, while the safe limits for those pollutants are 60 and 100 respectively. Atmospheric particulate matter, also known as Particulate Matter (PM), or Particulates, or Suspended Particulate Matter (SPM). Are microscopic solid and liquid matter suspended in earth's atmosphere. The term aerosols commonly refer to the particulates. These suspended particulates matter (SPM) are thoracic and respirable particles, inhalable coarse particles, which are with a diameter between 2.5 and 10 micrometer. Particulates are deadliest form of air pollutants due to their ability to penetrate deep into lungs and blood streams unfiltered causing permanent DNA mutation. So to reduce such problems for human being and also the environment the use of alternate fuel like biodiesels is proposed.

V. EXPERMENTAL SETUP

Single cylinder, Kirloskar make water cooled, four-stroke diesel engine having the ability to vary compression ratio was used in the study. Eddy current dynamometer is coupled to the engine using a load cell. Experiments were conducted at room temperature and pressure. Engine and the dynamometer are cooled using water which is circulated separately based in the required rate of flow. To measure the rate of flow of air, fuel and coolant necessary arrangement are made to control. Standard diesel was used to start the engine and the loads were applied in steps of 0, 25, 50, 75 and 100 % of full load. Gas Analyzer was used to measure the exhaust gas such as CO, HC, and NOx. CO2 and O2. Emission of Smoke was calculated using Bosch smoke meter (GASBOARD-5020H). K-type thermocouple was used to determine temperature of the exhaust gas. The engine was operated at 1500 rpm and water flow rate was 64 cc/sec**.** At each operating conditions exhaust emission levels were determined and stored for further analysis. The same procedure was repeated for different blends (10%, 20%, 30%, 40%, and50% Biodiesel. [3] proposed a principle in which another NN yield input control law was created for an under incited quad rotor UAV which uses the regular limitations of the under incited framework to create virtual control contributions to ensure the UAV tracks a craved direction. Utilizing the versatile back venturing method, every one of the six DOF are effectively followed utilizing just four control inputs while within the sight of un demonstrated flow and limited unsettling influences. Elements and speed vectors were thought to be inaccessible, along these lines a NN eyewitness was intended to recoup the limitless states. At that point, a novel NN virtual control structure which permitted the craved translational speeds to be controlled utilizing the pitch and the move of the UAV. At long last, a NN was used in the figuring of the real control inputs for the UAV dynamic framework. Utilizing Lyapunov systems, it was demonstrated that the estimation blunders of each NN, the spectator, Virtual controller, and the position, introduction, and speed following mistakes were all SGUUB while unwinding the partition Principle.

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VI. EMISSION ANALYSIS OF DIESEL ENGINE USING A MIXTURE OF WASTE COCONUT OIL AND SESAME OIL

BIODIESEL BLENDS AND DIESEL FUEL

CARBON MONOXIDE (CO) EMISSION

The data indicates that in the beginning there was a decreasing trend of CO emission and then gradually increased when brake power increased both for the blends as well as for diesel fuel. The data further indicates that B20 recorded low CO emission than that of other biodiesel blends and diesel as fuels. Due to the changes in physical and chemical properties of the fuel and A/F ratio.

	BP(kw)	Diesel	B10	B20	B30	B40	B50
CO	0	0.07	0.09	0.08	0.08	0.08	0.07
	0.7853	0.07	0.08	0.07	0.09	0.08	0.09
	1.5707	0.06	0.06	0.05	0.07	0.06	0.07
	2.3567	0.06	0.06	0.04	0.07	0.07	0.07
	3.1417	0.09	0.10	0.08	0.10	0.11	0.12

Table: CO emission of diesel engine using different blends of fuel at different BP

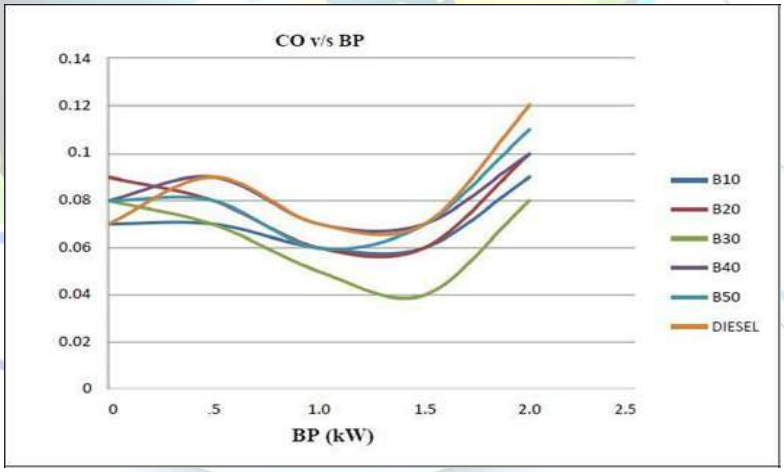

FIG: The comparison between carbon mono oxide and the brake power of the engine.

HYDROCARBON (HC) EMISSION

The variation of hydrocarbon emission with brake power for diesel and mixture of waste coconut oil and sesame oil biodiesel blends are presented in Table and illustrated in Fig. The data shows that the trend of increasing hydrocarbon emission for all the ratios of blends and the pure diesel are similar as the brake power increased. It was further observed that the hydrocarbon emission of B30 blend is lower than that of pure diesel. It is due to the ignition delay, which in turn leads to the storage of fuel in the combustion chamber

Table: HC emission of diesel engine using different blends of fuel at different BP

	BP(kw)	Diesel	B10	B20	B30	B40	B50
	0	34	36	34	42	47	41
	0.7853	38	46	37	45	47	44

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HC	1.5707	43	50	40	48	53	40
	2.3567	45	57	44	51	78	50
	3.1417	59	76	56	67	80	56

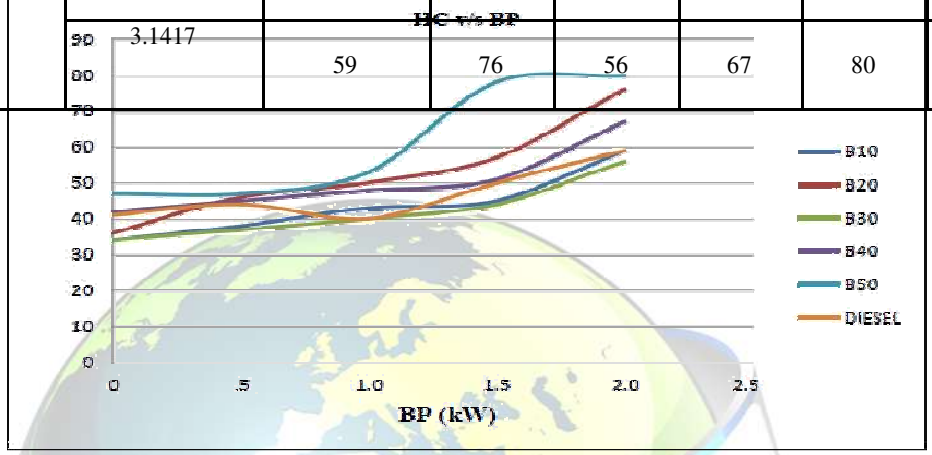

FIG: The comparison between Hydrocarbon and the brake power of the engine.

CARBON DIOXIDE (CO2) EMISSION

The variation of CO2 emission for mixture of waste coconut oil and sesame oil biodiesel blends and pure diesel are presented in Table. It could be seen from the figure that all the ratios of waste coconut oil and sesame oil biodiesel blends recorded lower percent of CO2 emission than that of diesel fuel. The result clearly indicates that the CO2 emission could be decreased markedly in the addition of waste coconut oil and sesame oil to diesel fuel.

Table: CO2 emission of diesel engine using different blends of fuel at different BP

	BP(kw)	Diesel	B10	B20	B30	B40	B50
CO_2	0	2.02	2.60	2.20	2.20	2.20	2.10
	0.7853	3.50	3.80	2.90	3.80	3.70	3.70
	1.5707	4.70	5.10	3.40	5.00	5.20	4.90
	2.3567	6.50	6.50	4.50	6.40	6.60	6.70
	3.1417	8.63	8.40	8.20	8.70	8.60	8.50

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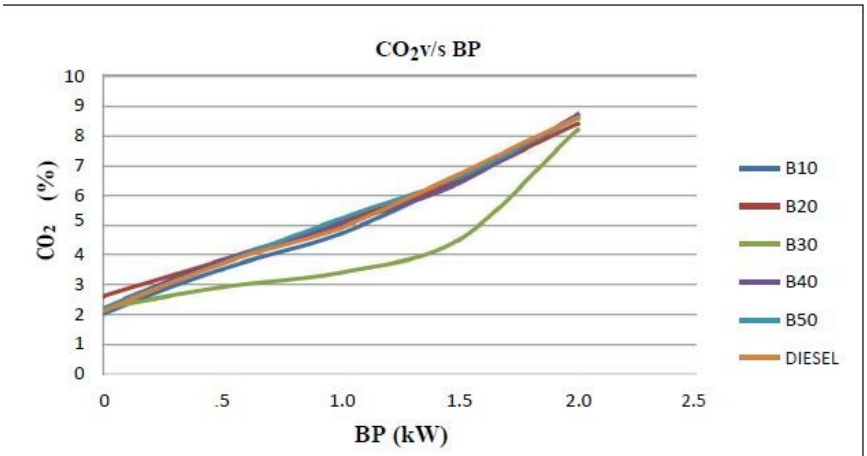

FIG: The comparison between Carbon-di-oxide and the brake power of the engine

NOX EMISSION

The variation of NOx emission with BP for various mixture ratios of waste coconut oil and sesame oil biodiesel blends is shown in Fig. 4.33. It is observed that the NOx emission is in increasing trend for all the ratios of waste coconut oil and sesame oil biodiesel blends and for the diesel fuel. The increase in NOx emission may be due to the oxygen present in the combustion chamber of waste coconut oil and sesame oil biodiesel blends and pure diesel, which is added to fuel rich zones, resulting in the oxidation of nitrogen.

Table: NO_X emission of diesel engine using different blends of fuel at different BP

	BP(kw)	Diesel	B10	B20	B30	B40	B50
NO_X	0	121	111	151	134	142	139
	0.7853	220	257	228	276	275	276
	1.5707	440	546	376	570	627	549
	2.3567	930	964	727	983	1031	991
	3.1417	1511	1452	1437	1543	1521	1405

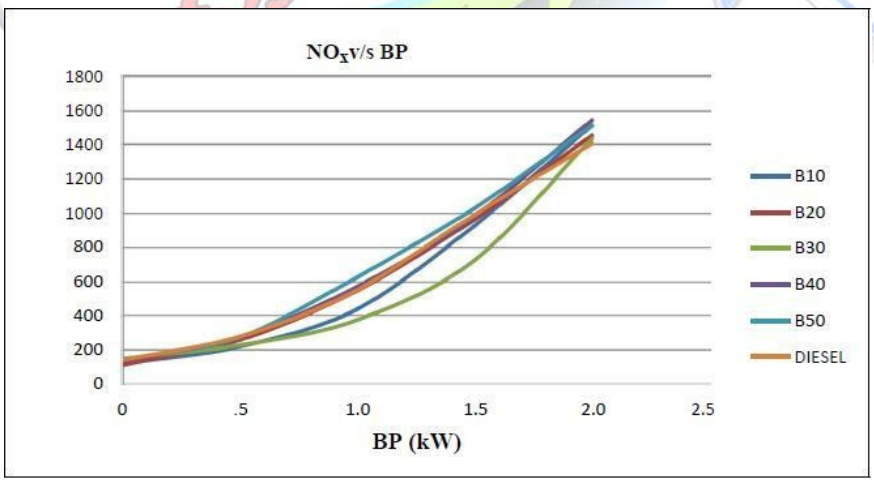

FIG: The comparison between NO_X and the brake power of the engine

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VII. ADVANTAGES OF BIODIESEL COMPARED TO PETROLUEM DIESEL FUEL

- Biodiesel may be used directly as a fuel for diesel engine.
- It can be used alone or can be blended with diesel to run.
- It has more lubricating property than that of diesel, which enhances the engine life
- It is environmental friendly and innocuous
- It is having higher flash point of around 150^0C, whereas diesel has it around 52^0C, which makes biodiesel safer to transport.
- Engine which uses biodiesel runs as usual since the fuel consumption, auto ignition, power plus output and torques are unaffected.
- It is an oxygenated fuel which makes it clear during burning
- Vegetable oil has lower cetane number compared to esters and is in line with diesel fuel
- Exhaust emission are lower with the use of biodiesel which emits sulphur dioxide-100%, hydrocarbons-56%, particulates-55%, carbon monoxide-43% and carbon dioxide- 78%
- Provides a domestic renewable energy supply.

VIII. CONCLUSION

The carbon monoxide emission increased as the proportion of mixture of waste coconut oil and sesame oil blend increased. In each test, exhaust related gas emissions, such as Nitrogen-oxide (NOx), Carbon monoxide (CO), oxygen (O2), Carbon dioxide (CO2), Hydrocarbon (HC) are measured. BSFC, BTE and Exhaust gas temperatures are computed from the measured fuel volumetric flow rate and calorific values.

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