International Journal of Engineering Research and Development
e- ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 22, Issue 6 (June 2026), PP 203-212

Impact of Ethanol and DEE with Diesel on the performance and PM emissions of a Single Cylinder CI Engine

Ayesha Binte Kibria[1*][0009-0003-3427-0615], Md. Tahjib Islam Ninad[2], Md. RafiqulAlam Beg[3]

[1]*Rajshahi University of Engineering and Technology, Rajshahi-6204, Bangladesh*
[2]*Rajshahi University of Engineering and Technology, Rajshahi-6204, Bangladesh*
[3]*Rajshahi University of Engineering and Technology, Rajshahi-6204, Bangladesh*
**Corresponding Author*

ABSTRACT

Diesel engines play a significant role in meeting the increasing energy demands; however, they release pollutants that are highly detrimental to human health and the environment. In pursuit of cleaner alternative fuels, ethanol and di-ethyl ether (DEE) have shown promise due to their oxygenated nature and potential for reducing particulate emissions. Ethanol, derived cost-effectively from sources such as maize and sugarcane, can be blended with diesel, while DEE is synthesized industrially through the dehydration of ethanol. In this study, the main objective is to reduce one of the harmful pollutants emitted by the IC engine, particulate matter. For this a blend of 95% diesel + 5% ethanol (D95 E5) and a blend of 90% diesel + 10% ethanol (D90 E10) was used with the application of three loads (2.72 kg, 4.44 kg and 5.9 kg to the engine at a constant speed of 1200±5 rpm. Efficiency of D100 blend at load 2.72 kg, 4.44 kg and 5.9 kg was 18.20%, 23.65% and 26.745% respectively. For D95 E5 Blend the efficiency at those three loads were increased by around 3%, 0.4% and 1.5% respectively and for E10 blend the efficiency was reduced on average 4.7%. PM emission reduced in both cases but E10 blend reduced that drastically. At this point the di ethyl ether (DEE) was introduced to E5 blend. So, the next 2 blends of diesel 90%, ethanol 5%, di ethyl ether 5% (D90 E5 DEE5) and the ratio of diesel 85%, ethanol 5% and di ethyl ether 10% (D85 E5 DEE10) were introduced to the engine with same operating conditions. For E5 DEE5 blend the efficiencies for the three loads were increased by 2.7%, 4% and 2.4% and for E5 DEE10 blend it is increased by 7.8%, 7.5% and 6% respectively with respect to D100. The PM emission of D85 E5 DEE10 was the lowest among all the blends.

Date of Submission: 15-06-2026 Date of acceptance: 29-06-2026

I. INTRODUCTION

As the number of world's population continues to increase, so does the demand for energy to power homes, industries, transportation, and infrastructure. This increased demand strains existing energy resources, particularly fossil fuels, amplifying concerns about resource depletion and environmental degradation due to increased emissions. In addition, population growth often leads to urbanization and industrialization, further escalating energy needs [1]. Also, the global transportation system relies mainly on diesel fueled vehicles for public and commercial transportation because they are much efficient and durable. But,these fossil fuels especially in transportation sector are responsible for the significant share in causing the global warming. Research shows about 28 of global warming is caused by the transportation sector. Which is really concerning. So, the necessity to find out an alternative source of energy which is in fact very efficient as well as environmentally friendly is now a must. [2]. At present, internal combustion engines (ICEs) power approximately 99.8% of global transportation, with 95% of the energy used in this sector derived from petroleum-based liquid fuels. [3]. So, basically, the world is mostly dependent on IC engines. In the transportation sector, compression-ignition (CI) engines have drawn more attention than spark-ignition (SI) engines due to their higher fuel efficiency resulting from a greater compression ratio. However, CI engines also release exhaust emissions that consist of gases, vapors, fine liquid droplets, and suspended particles. Despite having distinct chemical characteristics, the elements in this combination are harmful to human health because they can lead to allergies and illnesses [4]. All the particulate Diesel engines that work efficiently mostly release tiny particles called PM2.5, and many of them are even smaller, like PM0.1. These particles have a center made of carbon and are covered with organic materials. They also contain small amounts of sulphates, nitrates, metals, and other tiny substances [5]. The time diesel exhaust particles remain in the air can vary from just a few minutes to several days. However, detailed knowledge about how these particles change in the air—both physically and chemically—is still limited. Some research suggests that as these particles stay longer in the atmosphere, they may become even more harmful to human health.[3].To lower particulate matter (PM) emissions, several methods are now being used—one of which involves using liquid fuels in compression ignition (CI) engines. Liquid fuels are chosen because they have high energy content and are easy to transport. [4]. Hence, CI engine has been a hot topic over the last two decades. Among all alternative findings and researches, alternative fuel concept and dual fuel mode is the most attractive concept to decrease the environmental impacts while compensating the need for the straining fossil fuel demand.

I.I ALTERNATIVE FUEL

Transportation sectors are widely dependent on diesel engine. But petroleum is dwindling and diesel exhaust causes a serious respiratory health problem [6]. Also, inhalation of diesel particulate matters can cause cancer to many railroad workers [7] .Emission can be reduced with alternative fuel but then maintaining performance is also a great issue.Of all alternative fuels, alcohol, ether, LPG, natural gas and biodiesels are desirable. Alcohols and biodiesels are preferred as these possess the ability of reducing the harmful pollutants of engine exhaust. LPG are used for high duty engines [8]. Alcohols having the potential of producing cleaner combustion, is a topic for research these days.Having a proportion of oxygen in its composition ethanol gives a cleaner combustion which leads to less pollutants in exhaust.Diesel typically has a cetane number of 45–50, while ethanol ranges from 5–14. Due to the inverse relationship between octane and cetane numbers, ethanol lowers the cetanerating,leading to longer ignition delays with higher ethanol content [9]. The low heat value of a fuel directly affects the engine's power output. When ethanol is mixed with diesel, the overall energy content per volume decreases based on how much ethanol is added [10]. .Diethyl ether (DEE) can be a suitable alternative in this context, as it serves both as an oxygenated fuel and a cetane improver. The presence of oxygen in DEE helps reduce particulate matter (PM) emissions and, in some cases, nitrogen oxides (NOx), depending on the engine's operating conditions. [11]. Blending DEE with diesel can enhance the overall cetane rating of the mixture, potentially improving engine performance and reducing emissions. DEE also has a low ignition temperature, aiding in easier cold starts, which is beneficial for diesel engines in colder climates [11], [12].

M. A. de Carvalhoet. al. [13] worked on such a topic.They studied how a 54 kW diesel engine performs and what kind of emissions it produces when using blends of biodiesel, ethanol, and DEE..Different fraction of blends were used to examine the reduction of NOx and PM where biodiesel based blends reduced NOX and PM effectively. But with the addition of a cetaneimprover(DEE) the performance as well as the emission characteristics got a drastic reduction. However, they noted that ethanol's use in diesel blends is limited due to its property mismatch with diesel. Compared to diesel–biodiesel blends, ethanol–biodiesel mixtures showed greater NOx and PM reduction, a slight improvement in efficiency, and consistent decreases in smoke opacity—though CO emissions increased.Tutak et. al. [14] conducted experiments using diesel blended with 5%, 10%, and 15% diethyl ether (DEE) by weight in a single-cylinder diesel engine. The results showed that the blend with 10% DEE significantly improved brake thermal efficiency. This blend did not lead to a noticeable increase in NOx emissions. In addition, it substantially reduced smoke and carbon monoxide (CO) emissions across all load conditions. ..IsmetSezer [15] reviewed the DEE incorporation with diesel fuel and its effects. He discussed different properties of pure DEE and when it is blended with diesel fuel and different preparation methodology of DEE. He declared that DEE blending ratios with diesel up to 30% is proved and no phase can be seen for a couple of weeks.Eloisa Torres-Jimenez, et al. [16] examined the stability of ethanol and its physical and chemical properties.The fuels tested included pure mineral diesel (D100), a blend of 5% ethanol with diesel (E05D95), and ethanol–diesel blends with 10% (E10D90) and 15% (E15D85) ethanol by volume. The test concludes that at 30º C all the blends were stable but at 8ºC, D85 E15 showed a phase separation..Seokhwan Lee, et al. [17] tested a diesel engine using blends of diesel fuel mixed with DEE at 10%, 25%, and 50% by mass. As the DEE content increased, the ignition delay became shorter, which improved the fuel's ability to ignite automatically. The diesel engine's efficiency with a boosting system improved as the engine load increased. Additionally, at higher engine loads, pure diesel produced the highest particle number concentration, while this concentration decreased as the amount of DEE in the blend increased..Amr Ibrahim et. al. [18] investigated the impact of blending diethyl ether (DEE) with diesel fuel, using mixtures containing up to 15% DEE. The study showed that engine performance improved significantly under most load conditions. With 15% DEE, the engine's maximum brake thermal efficiency increased by 7.2%, and the minimum brake-specific fuel consumption dropped by 6.7% compared to using pure diesel. . Aditya Srinath et al. [19] conducted an experimental study using ethanol–diesel blends with DEE as an additive. The fuel blends tested were D95E5, D85E15, and D75E15DEE10. The efficiency of the ethanol blends was nearly the same as that of pure diesel fuel, but adding DEE caused a slight decrease in efficiency. BSFC of all blends were almost same except for D75 E15 DEE10. 5% decrement of BSFC was observed in this case.

Incorporation of ethanol with diesel has been explored in different studies. Incorporation of DEE in a ternary blend opens several research areas these days. As the chemical, proofs itself a better fuel alternative.Particulate matter emission has received comparatively little attention, which is an important research demand.In this study, we investigate the performance as well as the PM emission characteristics under different blends with diesel, ethanol and diethyl ether and analyze different performance parameters of CI engine when different blends are introduced.

II. MATERIAL AND METHODS

II.IMATERIALS AND SETUP

Diesel, Ethanol and DEE (Diethyl ether) were collected locally. Table1 shows some basic properties of the mixing stock.It is observed that DEE has a significantly higher cetane number compared to diesel fuel. In contrast, ethanol has a lower cetane number but contains the highest oxygen content among the three. The experimental trial was carried out using a Petter diesel engine, and the basic specifications of the engine are provided in table2. Single cylinder engine with 110 mm stroke and rated speed of approximately 1200 rpm was used in this case. A Solar 3100 was used to measure particulate matter from engine exhaust.

Type	Description
Engine No.	4062 AVI
Bore	80mm
Stroke	110mm
Compression Ratio	16.5:1
Rated Power	4.476 kW
Rated Speed	1200 rpm
No. of Cylinders	1
Swept Volume	553 cc
Fuel Injection Timing	24° BTDC
Dynamometer Type	DC generator

Table 1: Peter Diesel Engine Specifications

	Diesel	Ethanol	DEE
Oxygen (%)(wt)	-	34.8	21
Density(kg/m3)	830	788	713
Cetane Number	40.55	5 to 8	125

Table 2: Some basic properties of blending stock[11],[20],[21]

II.II **BLEND PREPARATION**

The experiment involved three different types of fuel, but the primary fuel was diesel fuel. Ethanol and diethyl ether (DEE) was mixed with the primary fuel at different fractions. The experimental procedure starts with the preparation of fuel blends. For this experiment, the prepared fuel blends are-

1. D100 (Diesel 100% v/v)
2. E5 (Diesel 95% v/v, Ethanol 5% v/v)

3. E10 (Diesel 90% v/v, Ethanol 10% v/v)
4. E5 DEE5 (Diesel 90% v/v, Ethanol 5% v/v, Diethyl Ether 5% v/v)
5. E5 DEE10 (Diesel 90% v/v, Diethyl Ether 10% v/v)

Figure 1: Prepared blends

Measuring beakers, burette and storage bottles were used in making these blends. Ethanol as well as DEE showed complete miscibility with diesel. The fractions are maintained properly by using burette and stop cork. After completing the blending procedure, the mixtures were stirred for 5 minutes. The blends were stored for about one and a half weeks in ambient conditions far from lights and there was no phase separation issue. The experimental DEE unit and the blends that involves DEE was stored in amber glass bottles to ensure stability of blend fraction and to avoid unexpected photo-chemical reactions. Figure1Shows the prepared blends. The blends containing DEE is stored in amber glassed bottles.The Density was measured in lab. Table 3 shows properties of different fuel blends.

Fuel Blend	**Measured Density** (kg/m^3)	**Oxygen** (% wt)	**Calorific Value** (MJ/kg)
Pure Diesel	860	0.00	43.00
D90 E10	861.84	1.60	42.26
D90 E5 DEE5	849.60	3.21	41.52
D90 E5 DEE5	853.74	2.50	51.88
D85 E5 DEE10	841.60	3.41	41.43

Table 3: Properties of Different Fuel Blends

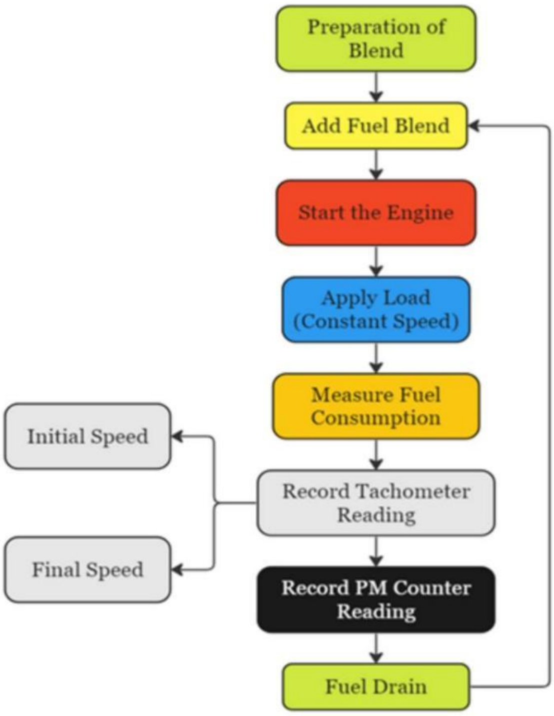

Figure 2: Experimental flowchart

II.III **TRIAL RUN**

The Peter diesel engine was initially run on pure diesel (D100) for data collection. Afterward, it was operated for around 30 minutes to drain the fuel, preparing it for the next The experimental setup is shown in figure 2. Which gives enough idea about the setup.Figure3 shows the Experimental set up.

The Peter diesel engine was initially run on pure diesel (D100) for data collection. Afterward, it was operated for around 30 minutes to drain the fuel, preparing it for the next The experimental setup is shown in figure 2. Which gives enough idea about the setup.Figure3 shows the Experimental set up.

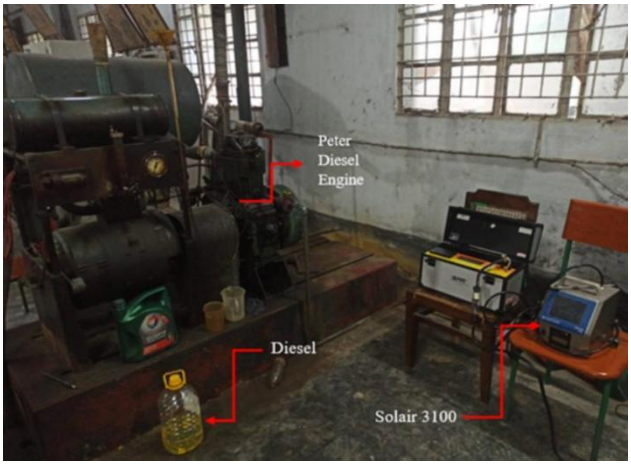

Figure 3: Experimental set up

III. DISCUSSION

III.I Engine Performance Analysis

Figure 4 shows a change in efficiency with respect to change in load for all prepared fuels. With the implementation of 2.72 kg, 4.44 kg and 5.9 kg load within a speed range, It has been observed that, increment in load or Brake Mean Effective Pressure causing increment in engine efficiency when the fuel is pure diesel.When the diesel fuel was substituted by 5% ethanol and the same operating condition, the efficiency increased but not significantly but a reduction in PM emission was noticed. When the third blend, D90 E10 was introduced the efficiency showed a gradual decremental trend. That is ethanol having lower cetane number and that's when increment in ethanol percentage in diesel ethanol blend, cause a decrement in efficiency.M. H. Atindra et al [22] also stated the same in their experiment that increasing ethanol percentage did a reduction in brake thermal efficiency. The D95 E5 blend was transformed to D90 E5 DEE5 blend to analyze the performance and emission. Addition of DEE improved the performance but not significantly. Whereas the PM emission was reduced in a great extent.

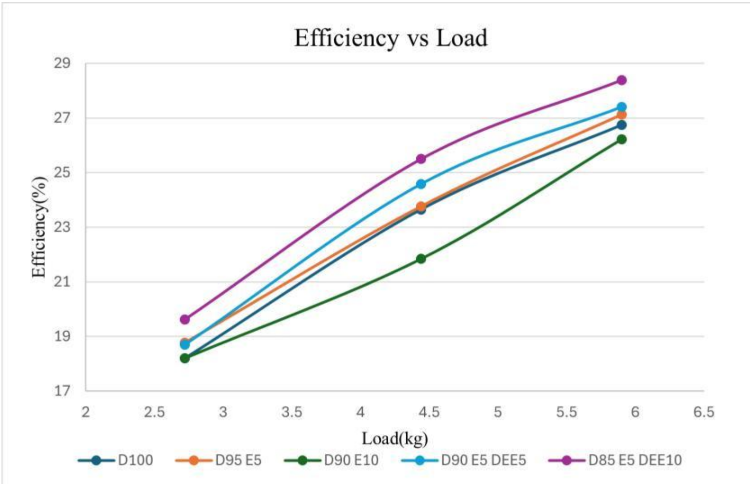

Figure 4: Brake Thermal Efficiency Vs Load

The final blend was the addition of 5% more DEE while substituting 5% of diesel. So, the DEE became 10%. This blend showed the maximum performance with minimum emission. For this blend efficiency got increased by 3.65% than that of diesel because of DEE having high cetane number and the fuel having high oxygen content. Which is almost same as what M. G. Krishnan et al [23] examined that incorporating DEE with diesel improves brake thermal efficiency.

III.II **Brake Specific Fuel Consumption Analysis**

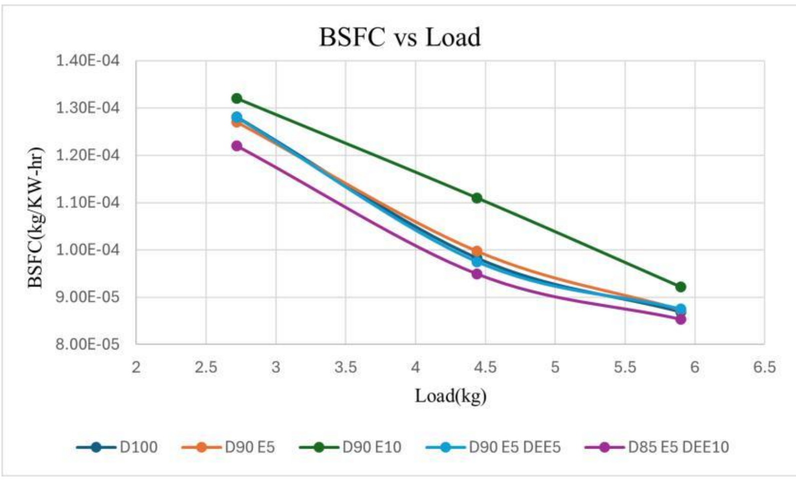

Figure 5: Brake Specific Fuel Consumption Vs Load

Figure 5 illustrates the load versus BSFC curve, depicting the performance pattern of various fuel blends under different loading conditions.As the load increases, the specific fuel consumption tends to decrease . Notably, the blend with 10% DEE demonstrates the most efficient fuel usage rate. Consequently, the D85E5DEE10 blend uses the least fuel to generate unit brake power. Conversely, the D90E10 blend is the least efficient in this scenario.The inefficiency results from ethanol's lower energy density relative to diesel and gasoline, which causes engines using high ethanol blends to consume more fuel in order to produce the same amount of energy as diesel which was also found the same by E. S. d. C. Freitas et al [24] in their experiment. So, to address this problem, DEE was incorporated into this experiment which cause a reduction in BSFC and a reducstion in BSFC was found just like S. K. Pillai et al [25] found a notable reduction in BSFC when DEE is introduced in the diesel blend.

III.IIIParticle Emission Trend

From the figure 6, it is seen that the particle emission was increased with loads. As at higher loads an engine consumes much fuel to overcome the performance loss. This produces much particulate matter. By adding oxygenated fuels (Ethanol and DEE) to diesel the combustion becomes cleaner. Because excess oxygen results in complete combustion. Thus the emission became cleaner as well.

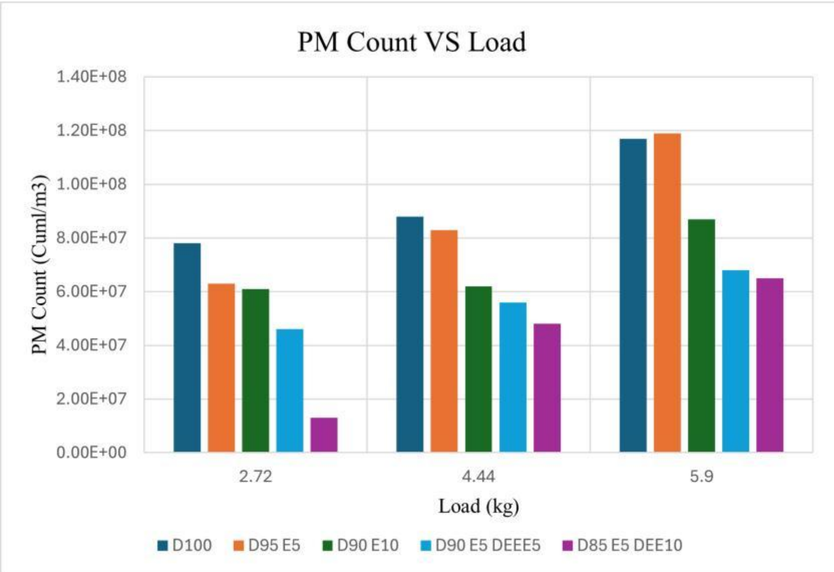

Figure 6: *PM emission Vs Load*

IV. CONCUSION

This study investigates the impact of blending ethanol and diethyl ether (DEE) with diesel fuel on emissions and engine performance in a CI engine. Among the tested combinations, the D85 E5 DEE10 blend—comprising 85% diesel, 5% ethanol, and 10% DEE—showed the most promising results. It produced significantly lower particulate matter (PM) emissions and higher brake thermal efficiency compared to pure diesel and other blends. D85 E5 DEE10 blend achieved higher brake thermal efficiency (BTE) under all load conditions: 19.62% at 2.72 kg, 25.5% at 4.44 kg, and 28.39% at 5.9 kg. Additionally, it recorded the lowest brake specific fuel consumption (BSFC) indicating improved fuel efficiency, 0.000122 Kg/kWh at load 2.72 kg, 0.0000949 kg/kWh at load 4.44 kg and 0.0000853 kg/kWh at load 5.9 kg. These findings highlight the potential of ethanol and DEE as effective diesel additives for reducing emissions and enhancing engine performance.

REFERENCES

[1]. Tripathi G, Sharma P, Dhar A, Sadiki A. Computational investigation of diesel injection strategies in hydrogen-diesel dual fuel engine. Sustainable Energy Technologies and Assessments. 2019;36:100543.
[2]. Sources of greenhouse gas emissions, available link:sources of greenhouse gas emissions, last access: [06-15-2025].
[3]. Leach F, Kalghatgi G, Stone R, Miles P. The scope for improving the efficiency and environmental impact of internal combustion engines. Transportation Engineering. 2020;1:100005.
[4]. Gaidar S, Karelina M, Laguzin A, Quang HD. Impact of operational factors on environmental safety of internal combustion engines. Transportation Research Procedia. 2020;50:136–44.
[5]. Hime NJ, Marks GB, Cowie CT. A comparison of the health effects of ambient particulate matter air pollution from five emission sources. International journal of environmental research and public health. 2018;15(6):1206.

[6]. Geng P, Cao E, Tan Q, Wei L. Effects of alternative fuels on the combustion characteristics and emission products from diesel engines: A review. Renewable and Sustainable Energy Reviews. 2017;71:523–34.
[7]. Rosenfeld PE, Spaeth KR, Hallman R, Bressler R, Smith GC. Cancer risk and diesel exhaust exposure among railroad workers. Water, Air, & Soil Pollution. 2022;233(5):171.
[8]. Geng P, Cao E, Tan Q, Wei L. Effects of alternative fuels on the combustion characteristics and emission products from diesel engines: A review. Renewable and Sustainable Energy Reviews. 2017;71:523–34.
[9]. Hansen AC, Zhang Q, Lyne PW. Ethanol–diesel fuel blends—-a review. Bioresource technology. 2005;96(3):277–85.
[10]. Li D, Zhen H, Xingcai L, Wu-Gao Z, Jian-Guang Y. Physico-chemical properties of ethanol–diesel blend fuel and its effect on performance and emissions of diesel engines. Renewable energy. 2005;30(6):967–76.
[11]. Sezer I. A review study on using diethyl ether in diesel engines: Effects on fuel properties, injection, and combustion characteristics. Energy & Environment. 2020;31(2):179–214.
[12]. Mahla S, Kumar S, Shergill H, Kumar A. Study the performance characteristics of acetylene gas in dual fuel engine with diethyl ether blends. International Journal on Emerging Technologies. 2012;3(1):80–3.
[13]. Carvalho MA de, Achy AR, Junior LC, Ferreira VP, Silva JA da, Pepe IM, et al. Mechanical and emissions performance of a diesel engine fueled with biodiesel, ethanol and diethyl ether blends. Journal of the Brazilian Society of Mechanical Sciences and Engineering. 2020;42:1–10.
[14]. Tutak W, Jamrozik A. Comparative analysis of combustion stability of diesel/ethanol utilization by blend and dual fuel. Processes. 2019;7(12):946.
[15]. Sezer I. A review study on using diethyl ether in diesel engines: Effects on fuel properties, injection, and combustion characteristics. Energy & Environment. 2020;31(2):179–214.
[16]. Torres-Jimenez E, Jerman MS, Gregorc A, Lisec I, Dorado MP, Kegl B. Physical and chemical properties of ethanol–diesel fuel blends. Fuel. 2011;90(2):795–802.
[17]. Lee S, Kim TY. Performance and emission characteristics of a DI diesel engine operated with diesel/DEE blended fuel. Applied Thermal Engineering. 2017;121:454–61.
[18]. Ibrahim A. Investigating the effect of using diethyl ether as a fuel additive on diesel engine performance and combustion. Applied Thermal Engineering. 2016;107:853–62.
[19]. Srinath A, Aerath AS, Kasiraman G. Experimental investigation on the usage of ethanol and DEE as additives in a CI engine. In: Journal of physics: Conference series. IOP Publishing; 2021. p. 012087.
[20]. Putrasari Y, Nur A, Muharam A. Performance and emission characteristic on a two cylinder DI diesel engine fuelled with ethanol-diesel blends. Energy Procedia. 2013;32:21–30.
[21]. Krishnamoorthi M, Malayalamurthi R. The influence of charge air temperature and exhaust gas recirculation on the availability analysis, performance and emission behavior of diesel-bael oil-diethyl ether blend operated diesel engine. Journal of Mechanical Science and Technology. 2018;32:1835–47.
[22]. Atindra MH, Vipulkumar SD, Krishan JV, Sunil US, Barot MC. An experimental investigation to evaluate the effect of ethanol blended diesel fuels on performance and emission of a CI engine.
[23]. Krishnan MG, Rajendran P, Pugalendhi V, Prakash SR. Numerical optimization and experimental investigation of renewable diethyl ether-fueled off-road CI engines for sustainable transportation. Isı BilimiveTekniğiDergisi. 2024;44(1):117–28.
[24]. Freitas ES de C, Guarieiro LLN, Silva MVI da, Amparo KK dos S, Machado BAS, Guerreiro ET de A, et al. Emission and performance evaluation of a diesel engine using addition of ethanol to diesel/biodiesel fuel blend. Energies. 2022;15(9):2988.
[25]. Pillai SK, Rajamanickam U, Khurana S. Impact of diethyl ether on performance and emission characteristics of a VCR diesel engine fueled by dual biodiesel. Energies. 2023;16(13):4863.

Appendix I
Performance of fuel
I. Performance of D100

Blend	Load (lb)	Speed (RPM)			10 cc fuel consumption time (sec)	Brake Power (Watt)	BSFC (kg/KWh)	Efficiency (%)
		Initial	Final	Average				
D100	6	1217	1196	1199	63	1072.2	1.28×10^{-4}	18.20
	9.8	1214	1181	1197	50	1749.3	9.83×10^{-5}	23.65
	13	1218	1191	1204.5	42	2334.9	8.69×10^{-5}	26.74

II. Performance of D95 E5

Blend	Load (lb)	Speed (RPM)			10 cc fuel consumption time (sec)	Brake Power (Watt)	BSFC (kg/KWh)	Efficiency (%)
		Initial	Final	Average				
D95 E5	6	1214	1195	1204.5	63	1077.19	1.27×10^{-4}	18.77
	9.8	1211	1191	1201	49	1754.47	9.97×10^{-5}	23.76
	13	1212	1185	1198.5	42	2323.13	8.73×10^{-5}	27.12

III. Performance of D90 E10

Blend	Load (lb)	Speed (RPM)			10 cc fuel consumption time (sec)	Brake Power (Watt)	BSFC (kg/KWh)	Efficiency (%)
		Initial	Final	Average				
D90 E10	6	1209	1190	1199.5	60	1072.72	1.32×10^{-4}	18.20
	9.8	1215	1186	1200.5	44	1753.74	1.11×10^{-4}	21.84
	13	1213	1183	1198	40	2322.2	9.22×10^{-5}	26.22

IV. Performance of D90 E5 DEE5

Blend	Load (lb)	Speed (RPM)			10 cc fuel consumption time (sec)	Brake Power (Watt)	BSFC (kg/KWh)	Efficiency (%)
		Initial	Final	Average				
D90 E5 DEE5	6	1210	1196	1203	62	1075.85	1.28×10^{-4}	18.70
	9.8	1215	1181	1201	50	1754.5	9.75×10^{-5}	24.58
	13	1214	1181	1197.5	43	2321.19	8.75×10^{-5}	27.40

V.Performance of D85 E5 DEE10

Blend	Load (lb)	Speed (RPM)			10 cc fuel consumption time (sec)	Brake Power (Watt)	BSFC (kg/KWh)	Efficiency (%)
		Initial	Final	Average				
D85 E5 DEE 10	6	1216	1194	1205	64	1077.64	1.22×10^{-4}	19.62
	9.8	1212	1182	1197	51	1748.6	9.49×10^{-5}	25.5
	13	1210	1186	1198	43	2321.16	8.53×10^{-5}	28.39

VI. Particle Emission

Blend	Load	Particulate Matter Count (Cuml/m3)							
		0.3 µ	0.5 µ	0.7 µ	1 µ	3 µ	5 µ	10 µ	Total
D 100	6	52652887	31288859	17404407	13882758	90617	211.9	0	1.15E+08
	9.8	45415151	18010125	7913097	5837160	25355.9	423.8	0	7.72E+07
	13	43982291	24710929	7429710	4644302	0	0	0	8.08E+07
D 95 E5	6	46622203	33451529	21311479	17932291	159198.5	282.5	0	1.19E+08
	9.8	45119991	19279615	8525382	6316027	6316027	31147.5	353.1	8.56E+07
	13	39046011	22160421	2374628	1507936	5155	68	0	6.51E+07
D 90 E 10	6	39602075	15851126	5957089	4194746	10876	0	0	6.56E+07
	9.8	37743921	19629089	6097500	3985754	73	0	0	6.75E+07
	13	36983067	21439618	1930751	2332905	82	15	0	6.27E+07
D 90 E 5 DEE 5	6	35733139	6881344	1972394	1280298	4661.5	211.9	0	4.59E+07
	9.8	33529736	11103847	2379290	1461815	1907	70	0	4.85E+07
	13	37495307	18972596	2115862	1868265	63	0	0	6.05E+07
D 85 E 5 DEE 10	6	9636382	2797416	560161	296996	0	0	0	1.33E+07
	9.8	40113875	10286242	1761283	1045738	1836.4	0	0	5.32E+07
	13	43455963	22088191	2125127	3477011	0	0	0	7.11E+07