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# Hydrotreated Vegetable Oil for Sustainable and Resilient Military Logistics: Performance and Emission Assessment of Logistics Vehicles

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**Abstract**

The transition toward sustainable energy solutions has become a strategic priority for modern defence organizations. This study evaluates the impact of hydrotreated vegetable oil (HVO) and its blends on the performance and emissions of a compression ignition engine (OM 366 LA II), which represents the mid-range logistics vehicles deployed by the Lithuanian Armed Forces. Numerical simulations were performed using the Diesel-RK software and validated against engine manufacturer performance data, achieving a mean absolute torque difference of 0.64%. The results indicate that increasing the HVO fraction reduces brake specific fuel consumption (BSFC) and nitrogen oxides ($NO_x$) emissions.

**KEY WORDS:** *Compress Ignition Engine, Hydrotreated Vegetable Oil, petroleum diesel, emission, military vehicles, logistics*

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## 1. Introduction

The modernization of military logistics and the reduction of the carbon footprint in defense sectors have become critical priorities under the NATO Green Defence framework [1]. This transition will affect tactical and logistical operations. The transition toward sustainable energy within defense sectors is rapidly shifting from a voluntary environmental initiative to a mandatory strategic requirement driven by European regulations and geopolitical realities. The need to reduce greenhouse gas (GHG) emissions from the transport sector has increased interest in low-carbon fuels for internal combustion engines [2]. Under the European Green Deal and the Climate Change and Defence Roadmap, EU member states must align their military operations with net-zero emission targets by 2050 [3]. Historically, defense organizations operated under environmental exemptions. However, newer EU frameworks like the Fit for 55 package are forcing armed forces to account for their carbon footprint and reduce dependency on traditional petroleum fuels[4]. Reducing fossil energy use is also directly tied to operational resilience during prolonged conflicts. Furthermore, as civilian infrastructure moves away from fossil fuels, military organizations will face rising fuel prices and difficulties cooperating with civilian logistics networks during joint operations [5]

The Lithuanian Armed Forces face a complex challenge transition towards sustainable energy without compromising operational readiness or fuel security [6]. Conventional first-generation biofuels like Fatty Acid Methyl Esters (FAME) introduce operational risks during long-term strategic storage, including moisture absorption, microbial contamination, and increased low-temperature viscosity [7]. In contrast, advanced renewable fuels such as Hydrotreated Vegetable Oil offer a viable alternative. HVO has a chemical structure identical to petroleum diesel, which ensures high thermal stability, good cold-flow properties, and storage longevity of up to ten years [8]. Another alternative under investigation is third-generation biofuel produced from microalgae. Algae-based diesel is highly attractive because microalgae grow rapidly, do not compete with food crops for agricultural land, and can utilize wastewater or carbon dioxide for growth [9]. Depending on the processing method, algae can be converted into either a FAME-like biodiesel through transesterification or high-quality hydrotreated alkanes similar to HVO. However, algae diesel currently faces major challenges regarding high production costs and heavy energy consumption during the harvesting and oil extraction phases, which limits its availability for large-scale military supply chains [10]. Another option is Gas-to-Liquid (GTL) diesel, which is produced from natural gas or biomass through the Fischer-Tropsch process. GTL fuel contains no aromatics or sulfur, has a high cetane number, and can be used directly in existing military engines without modifications [11]. Other alternative options include biodiesel-ethanol-diesel (BED) micro-emulsions, which help improve fuel spray atomization and reduce soot formation due to the high oxygen content in ethanol. However, these mixtures face challenges with phase separation at low temperatures, making them difficult to use in unpredictable military environments [12]. Recently, researchers have also focused on e-fuels (electrofuels), such as e-diesel, which are produced using captured carbon dioxide and renewable hydrogen. E-diesel has a very high purity and behaves exactly like premium petroleum diesel, but its production costs are currently too high for large-scale military adoption [13]. Furthermore, some military studies explore the use of crude waste plastic pyrolysis oil (WPPO) blended with diesel. While WPPO helps recycle plastic waste and lowers carbon dioxide ($CO_2$) emissions, it often contains high amounts of heavy metals and chlorine, which can cause severe fuel injector deposits and corrosion during extended field operations [14]. Main fuel properties are presented in Table 1.

Table 1.

Fuel properties

| Fuel Type | Density at 15 °C (kg/m³) | Cetane Number | H/C Ratio | Carbon Molecule Number | Lower Heating Value (MJ/kg) | Main Operational Challenges | References |
|---|---|---|---|---|---|---|---|
| Petroleum Diesel (Ref.) | 834–866 | 49 – 55 | ~1.82 | C10 – C20 | ~42.4 | Baseline fuel for performance and emission comparison | [15] |
| HVO (Hydrotreated) | ~780 | 70 – 80 | ~1.95 | C15 – C18 | ~44.0 | High production costs compared to petroleum diesel | [16] |
| GTL (Gas-to-Liquid) | 760–783 | 70 – 89 | ~2.12 | C10 – C22 | ~43.6 | Limited distribution networks and source availability | [15] |
| BED (Micro-emulsion) | ~820 – 840 | 40 – 48 | ~1.80 | C2 – C18 | ~38.5 – 40.0 | High risk of phase separation at low temperatures | [17] |
| Algae Diesel (Third-gen) | ~840 – 865 | 48 – 55 | ~1.72 | C14 – C18 | ~39.0 – 41.0 | High production costs, energy-intensive extraction, and harvesting challenges | [18] |
| E-diesel (Electrofuel) | ~780 – 800 | 65 – 75 | ~1.85 | C11 – C18 | ~43.0 – 44.0 | Extremely high current production and synthesis costs | [19] |
| WPPO (Plastic Pyrolysis) | ~790 – 820 | 48 – 52 | ~1.71 | C8 – C24 | ~41.0 – 43.0 | Heavy metals, chlorine, high injector deposits and corrosion | [20] |
| FAME (First-gen) | ~883 | 51 – 56 | ~1.70 | C16 – C18 | ~37.2 | Moisture absorption, microbial growth, poor cold flow | [21] |

While alternatives such as FAME, microalgae-based biofuels, BED micro-emulsions, e-fuels, and WPPO blends present specific environmental advantages, their widespread military implementation remains constrained by critical technical and economic barriers. FAME and BED have problems regarding storage longevity and low-temperature stability, which directly threaten tactical preparation. Meanwhile, next-generation solutions like algae-derived diesel and e-diesel are currently have a large production costs and immature supply chains, and WPPO blends introduce severe risks of engine corrosion and component wear. Therefore, to ensure a wide supply chain and direct replacement of diesel fuel further review focuses on HVO and GTL diesel. Both HVO and GTL possess high cetane numbers, chemical stability during prolonged storage, and seamless compatibility with existing compression ignition engines, making them the primary candidates for application.

Data from controlled compression ignition engine testing confirms that replacing petroleum diesel with HVO reduces tailpipe $CO_2$ emissions. Experiments on multicylinder compression ignition engine test benches confirm that running on pure HVO reduces $CO_2$ emissions by nearly 9% under steady state and full load cycles across the entire engine speed range [22]. This localized decrease is heavily dictated by the molecular structure of these alternative fuels. Their higher hydrogen to carbon (H/C) ratio reduces the number of carbon molecules within the hydrocarbon chains, resulting in lower carbon emissions [23]. Furthermore, thermodynamic analysis within research engines indicates that the high cetane number (70–80) of HVO shortens the ignition delay period. This structural property advances the main heat release phase closer to the top dead center (TDC), enhancing the engine's thermal efficiency and reducing specific $CO_2$ emission [24]. Conversely, when evaluating lower-concentration mixtures, such as diesel mixture with HVO by mass, for example

20% of HVO or 50% of HVO blends, engine test setups show a strictly linear relationship between the blending ratio and carbon based emission, fixating a minor but consistent $CO_2$ reduction of only 0.8% to 1.5% [8].

When evaluating compression ignition engine emissions, operating on GTL results in an approximate 4% reduction in tailpipe $CO_2$ under steady state and full load cycles across the entire engine speed range compared to petroleum diesel. This reduction is due to the molecular structure of GTL, its higher hydrogen to carbon ratio results in lower carbon dioxide and higher water vapor formation during combustion. This enhanced combustion profile is a direct consequence of the fuel's chemical composition, which is characterized by a higher paraffinic content and significantly lower aromatic content compared to conventional diesel [25]. Experimental data confirms that GTL fuel reduce nitrogen oxides emissions compared to conventional petroleum diesel, particularly under medium and high load conditions. This mitigation is primarily governed by the fuel's chemical properties; the high cetane number shortens the ignition delay period. Consequently, this alters the heat release rate, lowering the peak combustion temperatures in-cylinder and suppressing the thermal $NO_x$ formation mechanism [15].

The primary objective of this study is to precisely evaluate the impact of alternative fuels and their blends with petroleum diesel on the engine performance and emissions of military vehicles. Although both HVO and GTL alternatives have similar properties and could serve as viable solutions, HVO was selected for further analysis due to its lower production cost. By utilizing the Diesel-RK numerical simulation tool, this research aims to provide a data for implementing cleaner fuel strategies, specifically focusing on HVO, in military logistics applications.

## 2. Materials and Methods

The Diesel-RK numerical simulation tool was selected for the numerical analysis of the combustion processes. The software features a comprehensive database of various fuels and enables the formulation of custom fuel mixtures. Accordingly, for this application, pure petroleum diesel is designated as 100PD0HVO, pure HVO as 0PD100HVO, and a 50/50% blend of petroleum diesel and HVO by mass is labeled as 50PD50HVO. The properties of the petroleum diesel as defined within the Diesel-RK simulation tool are presented in Figure 1.

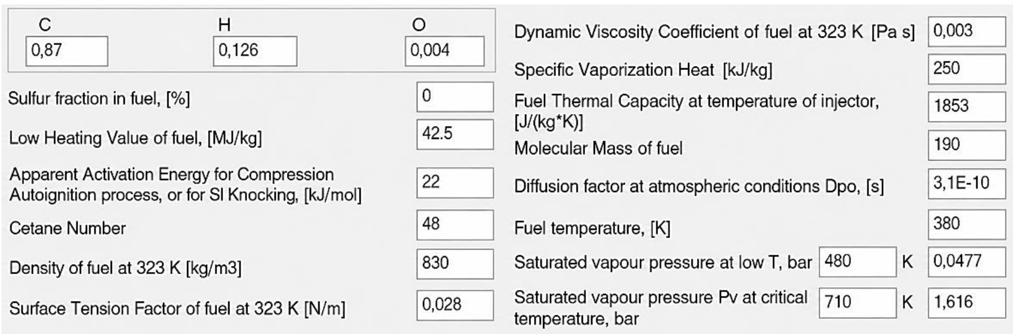


Fig.1. Petroleum diesel properties in numerical simulation tool Diesel-RK.

Baseline fuel properties are needed to accurately develop a validable engine model. The properties of the fuel mixtures used are presented in Table 2.

Table 2.

Fuel mixture properties

| Parameter | Unit | 100PD0HVO | 50PD50HVO | 0PD100HVO |
|---|---|---|---|---|
| Carbon mass fraction (C) | - | 0.870 | 0.860 | 0.849 |
| Hydrogen mass fraction (H) | - | 0.126 | 0.138 | 0.151 |
| Oxygen mass fraction (O) | - | 0.004 | 0.002 | 0.000 |
| Low Heating Value of fuel | MJ/kg | 42.50 | 43.25 | 44.00 |
| Apparent Activation Energy for Compression Autoignition process | kJ/mol | 22.0 | 20.5 | 19.0 |
| Cetane Number | - | 48.0 | 62.0 | 76.0 |
| Density of fuel at 323 K | kg/m³ | 830.0 | 797.5 | 765.0 |
| Surface Tension Factor of fuel at 323 K | N/m | 0.028 | 0.027 | 0.026 |
| Dynamic Viscosity Coefficient of fuel at 323 K | Pa·s | 0.0030 | 0.0026 | 0.0022 |
| Specific Vaporization Heat | kJ/kg | 250 | 270 | 290 |
| Fuel Thermal Capacity at temperature of injector | J/(kg·K) | 1853 | 1916 | 1980 |
| Molecular Mass of fuel | - | 190.0 | 212.5 | 235.0 |
| Diffusion factor at atmospheric conditions Dpo | s | 3.1E-10 | 3.0E-10 | 2.9E-10 |
| Saturated vapour pressure at low T (at 480 K) | bar | 0.0477 | 0.0428 | 0.0380 |
| Saturated vapour pressure Pv at critical temperature (at 710 K) | bar | 1.616 | 1.483 | 1.350 |

The fuel mixtures were simulated using a compression ignition engine model representative of the military vehicles deployed by the Lithuanian Armed Forces. Since the exact fleet size and detailed technical information regarding military vehicles operated by the Lithuanian Armed Forces are classified and not publicly accessible, a representative selection of vehicles commonly utilized in military logistical operations was compiled for this study. The selected vehicles cover a broad range of payload capacities and operational requirements, ranging from medium duty transport platforms to heavy duty logistics and support vehicles. As shown in Table 3, all analyzed vehicles are equipped with large-displacement, turbocharged compression ignition engines, which are characterized by high torque output.

Table 3.

Vehicles utilized in Lithuanian Armed Forces logistical activities

| Vehicle / Parameter | UNIMOG U 5000 | UNIMOG U 1550L | UNIMOG U 2150L/38 | SISU E13TP | Mercedes-Benz Arocs 4142 AK | Mercedes-Benz ZETROS 3643 |
|---|---|---|---|---|---|---|
| Gross mass, kg | 12500 | 8500 | 14000 | 27000 | 42000 | 116000 |
| Engine code | OM 924 LA | OM 366 LA | OM 366 LA II | Caterpillar C13 | OM 471 LA | OM 460 LA |
| Number of cylinders | 4 | 6 | 6 | 6 | 6 | 6 |
| Nominal power, kW | 130 | 150 | 155 | 332 | 310 | 315 |
| at rpm | 2200 | 2600 | 2400 | 2100 | 1600 | 1600 |
| Nominal torque, Nm | 675 | 800 | 750 | 2270 | 2100 | 2100 |
| Engine capacity, $cm^3$ | 4249 | 5958 | 5958 | 12500 | 12800 | 12800 |
| Compression ratio | 17.4 | 17.1 | 16.5 | 17.3 | 20.3 | 18 |
| Bore, mm | 106 | 97.5 | 97.5 | 130 | 132 | 128 |
| Stroke, mm | 136 | 133 | 133 | 157 | 156 | 166 |
| References | [26] | [27] | [28] | [29] | [30] | [31] |

Based on Table 2, which outlines the logistical vehicles deployed by the Lithuanian Armed Forces, the OM 366 LA II engine was selected for numerical simulation using the Diesel-RK software tool. This selection is justified by the engine's displacement of 5,958 $cm^3$ and a piston stroke of 133 mm, parameters that represent the mid-range power output engine most widely utilized within military logistical fleets. Furthermore, the OM 366 LA II constitutes an improved and technologically modernized version of the earlier OM 366 LA engine, featuring enhanced fuel injection and mixture formation characteristics that are particularly important for accurate combustion and emissions modeling. Consequently, this engine can be considered a representative benchmark for evaluating the performance of alternative fuel blends in military vehicle applications.

To assess the influence of fuel composition on engine performance, emissions formation, and fuel consumption characteristics through the entire operating range, eight engine speed points, at full load, were selected for numerical simulations: 700, 900, 1150, 1400, 1650, 1900, 2150, and 2400 rpm, thereby starting from low-speed conditions up to the rated speed of maximum power output. At each operational point, the respective combustion parameters and fuel mixture compositions were defined. Model validation was performed by comparing simulation results against the engine's manufacturer dynamometer performance curve using standard petroleum diesel as the reference fuel. During this validation phase, key internal combustion parameters were iteratively adjusted to achieve a precise correlation between the simulated and experimental power and torque profiles.

## 3. Results

To validate the Diesel-RK numerical simulation engine model and its combustion parameters engine torque was selected as the primary validation criterion due to its direct thermodynamic correlation with engine power, $P_e$, and in-cylinder pressure (Fig. 2). A comparative analysis between the engine manufacturer torque, $M_e$, data and simulation torque data was performed across the entire operational speed range from 700 rpm to 2400 rpm. The results showed that the mean absolute percentage difference across all eight designated operating points was found to be 0.64%, confirming the high validation of the model. The highest simulation precision was achieved at 1150 rpm with absolute percentage difference of just 0.44%, while the maximum difference did not exceed 0.94% at the low engine speed of 900 rpm. All tested points absolute percentage difference remains below 1% well within the universally accepted engineering validation threshold of 5%. Therefore results gathered from this model simulation is considered to be accurate.

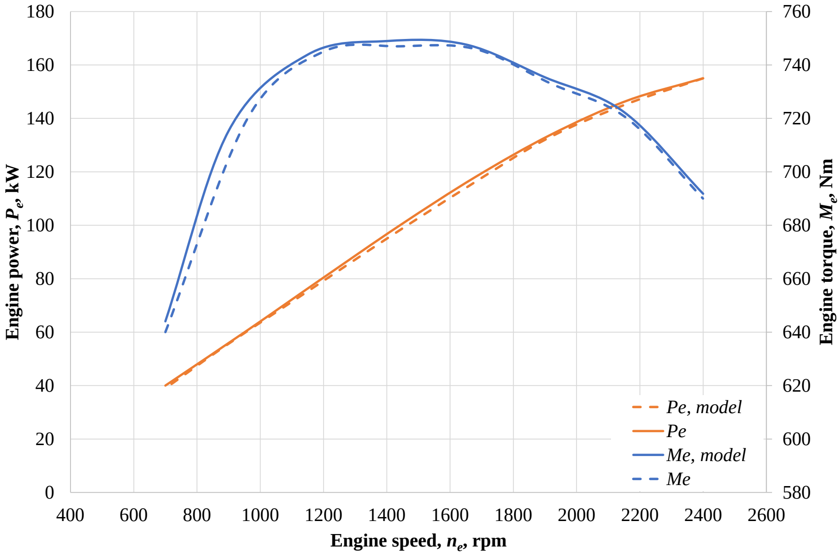


Fig.2. Validation of the Diesel-RK engine simulation model.

Brake specific fuel consumption (BSFC) analysis revealed that increasing the proportion of HVO in the fuel blend reduced BSCF at low and medium engine speeds, whereas a slight increase was observed at the highest engine speeds (Fig. 3). Compared with 100PD0HVO, the use of 0PD100HVO reduced BSFC by 2.56% at 700 rpm, 1.46% at 900 rpm, 0.82% at 1150 rpm, 0.55% at 1400 rpm, 0.30% at 1650 rpm, and 0.10% at 1900 rpm. The lowest BSFC value of 212.89 g/kWh was obtained at 1400 rpm using pure HVO fuel. However, at the upper limit of the engine speed range, the trend reversed, and BSFC increased by 0.16% and 1.57% at 2150 and 2400 rpm, respectively. The 50PD50HVO blend demonstrated intermediate results across the entire operating range. The observed reduction in BSFC at lower and medium engine speeds can be attributed to the higher cetane number and improved combustion characteristics of HVO fuel. A higher cetane number shortens ignition delay, resulting in earlier and more stable combustion, improved heat release utilization, and more efficient conversion of chemical energy into useful work. The slight increase in BSFC observed at the highest engine speeds may be explained by the lower density of HVO compared with petroleum diesel. Under high-speed operating conditions, where injection duration becomes increasingly limited, the lower volumetric energy content of HVO can lead to a marginal increase in the injected fuel quantity required to maintain equivalent engine load and torque output. Consequently, the advantages associated with improved ignition quality become less pronounced at higher rotational speeds.

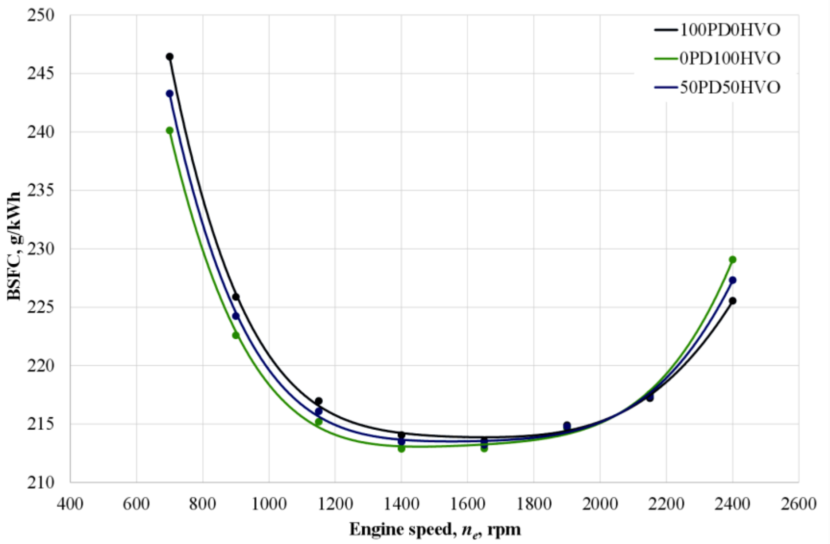


Fig.3. BSFC of OM 366 LA II engine working on different fuel mixtures.

The simulation results indicate that increasing the HVO fraction in the fuel blend led to a consistent reduction in $NO_x$ emissions throughout the entire engine operating range (Fig. 4). Compared with 100PD0HVO, the use of 0PD100HVO reduced $NO_x$ emissions by 9.2% at 700 rpm, 10.0% at 900 rpm, 14.1% at 1150 rpm, 14.0% at 1400 rpm, 14.5% at 1650 rpm, 14.8% at 1900 rpm, 15.0% at 2150 rpm, and as much as 28.1% at 2400 rpm. The 50PD50HVO blend exhibited intermediate behavior, reducing $NO_x$ emissions by approximately 0.7–7.4% depending on the engine speed. The highest absolute $NO_x$ emissions were observed at low engine speeds, peaking at 16.82 g/kWh for diesel fuel at 700 rpm, where the lowest values were recorded at the rated speed of 2400 rpm. The reduction in $NO_x$ emissions can be primarily attributed to the superior combustion characteristics inherent to HVO fuel. HVO possesses a significantly higher cetane number than petroleum diesel, which shortens the ignition delay period and reduces the mass of premixed fuel available for rapid, uncontrolled combustion. Consequently, the peak heat release rate and maximum in-cylinder temperatures decrease, effectively suppressing the thermal $NO_x$ formation mechanism (Zeldovich mechanism). Similar trends have been widely reported in literature, where HVO utilization typically resulted in 6–12% lower $NO_x$ emissions due to reduced ignition delay and lower heat release intensity during the premixed combustion phase.

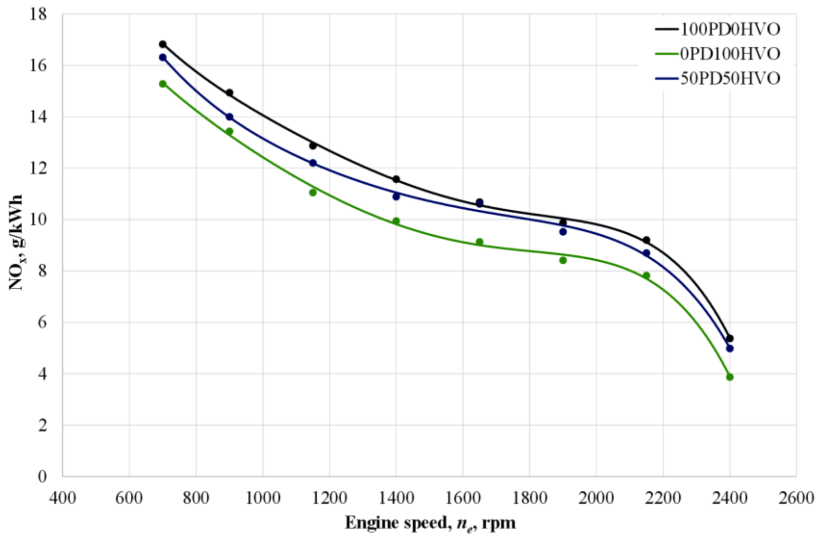


Fig.4. $NO_x$ emission of OM 366 LA II engine working on different fuel mixtures.

The Bosch Smoke Number (BSN) results demonstrate that replacing conventional diesel fuel with HVO significantly reduces smoke formation across the entire engine speed range (Fig. 5). For pure HVO, the BSN decreased from 0.87 to 0.83 at 700 rpm (4.6% reduction), from 0.73 to 0.69 at 900 rpm (5.5% reduction), from 0.65 to 0.61 at 1150 rpm (6.2% reduction), and from 0.50 to 0.40 at 2400 rpm (20.0% reduction).

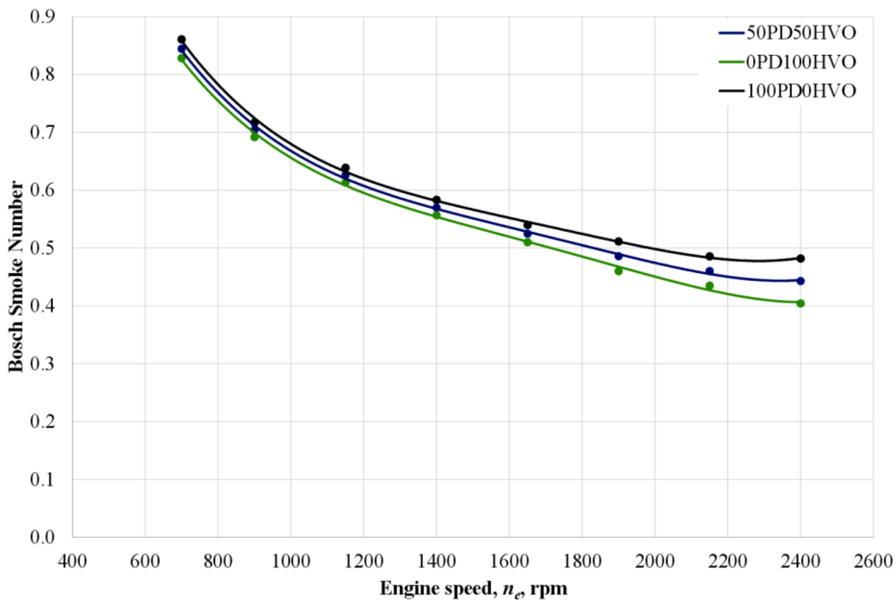


Fig.5. Bosch Smoke Number of OM 366 LA II engine working on different fuel mixtures.

The 50PD50HVO blend exhibited intermediate values, indicating a gradual and predictable reduction in smoke emissions with increasing HVO concentration. The most substantial smoke reduction occurred at high engine speeds, where the variance between conventional petroleum diesel and HVO became most pronounced. The lower smoke emissions observed with HVO are closely associated with its paraffinic chemical structure and the complete absence of aromatic hydrocarbons, which are major precursors for soot formation. In addition, HVO exhibits a lower carbon to hydrogen ratio and promotes a more homogeneous fuel–air mixture, leading to more complete oxidation. The current simulation results confirm this fundamental tendency, showing that HVO effectively suppresses soot generation over the entire operating range of the simulated engine.

## 4. Conclusions

A representative compression ignition engine model (OM 366 LA II), reflecting mid-range military logistics vehicles, was successfully developed and validated using the Diesel-RK simulation tool. The comparative analysis between simulated and empirical torque characteristics has a mean absolute percentage difference of 0.64%, confirming the reliability of the numerical model for alternative fuel evaluation.

The application of 0PD100HVO significantly enhanced fuel economy under low to medium speed operations. Compared to 100PD0HVO, HVO reduced BSFC by up to 2.56%, with peak between 700 rpm and 1400 rpm, which directly correspond to the typical operational duty cycles of military logistics convoys.

Increasing the HVO mass fraction led to a reduction of $NO_x$ emissions across the entire engine operating speed. 0PD100HVO reduced $NO_x$ emission from 9.2% to 28.1% compared to 100PD0HVO, primarily due to increased cetane number which shortens the ignition delay period and subsequently suppresses thermal $NO_x$ formation.

HVO reduces particle and smoke emission as BSN decreased by up to 20.0% at higher engine speeds. This substantial drop in smoke opacity indicates minimized soot forming, resulting from HVO paraffinic chemical structure, lower carbon mass fraction, and more homogeneous fuel–air mixture preparation.

Due to HVO properties and directly compatibility with existing compression ignition engines, HVO represents a highly suitable solution for sustainable defense logistics. Implementing HVO would reduce BSFC, $NO_x$ and smoke emissions. Consequently, a substantial overall reduction in environmental footprints can be achieved if HVO would be used across the logistical vehicle fleets.

## References


1. NATO Climate Change and Security Action Plan Available online: https://www.nato.int/en/about-us/official-texts-and-resources/official-texts/2021/06/14/nato-climate-change-and-security-action-plan (accessed on 1 June 2026).
2. *Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 Amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as Regards the Promotion of Energy from Renewable Sources, and Repealing Council Directive (EU) 2015/652*; 2023;
3. **Hidalgo, M. M.** Climate Change and Defense in the European Union: Progress towards a Greater Integration. Diálogos Soberania e Clima, 2023, Special No. 2. Available online: https://soberaniaeclima.org.br/wp-content/uploads/2024/04/Dialogos-Soberania-e-Clima-Especial-N2-out-2023-Maria-del-Mar-Hidalgo-03-Ingles.pdf (accessed on 1 June 2026).
4. ReFuelEU Aviation Initiative: Summary of the Commission Proposal and the Parliament's Draft Committee Report | Think Tank | European Parliament Available online: https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)729457 (accessed on 1 June 2026).
5. **Liwång, H.** Future National Energy Systems, Energy Security and Comprehensive National Defence. *Energies* 2023, *16*, 6627, doi:10.3390/en16186627.
6. Strengthening Lithuanian energy sector resilience though effective use of NATO, EU and Baltic Sea region instruments Available online: https://data.kurklt.lt/en/project/strengthening-lithuanian-energy-sector-resilience-though-effective-use-of-nato-eu-and-baltic-sea-region-instruments/ (accessed on 8 June 2026).
7. **Jain, S.; Sharma, M.P.** Stability of Biodiesel and Its Blends: A Review. *Renewable and Sustainable Energy Reviews* 2010, *14*, 667–678, doi:10.1016/j.rser.2009.10.011.
8. **Rimkus, A.; Žaglinskis, J.; Pukalskas, S.** Effects of Hydrotreated Vegetable Oil and Diesel Blends on Combustion, Energy Performance, and Emissions of a Compression Ignition Engine Under EGR-Controlled Operation. *Journal of Marine Science and Engineering* 2026, *14*, 665, doi:10.3390/jmse14070665.
9. **Saravanan, G.; Thiyagarajan, P.** Energy, Combustion and Emission Characteristics of a Dual-Fuel CI Engine Fuelled with Biogas and Diethyl Ether–Blended Microalgae Biodiesel. *Applied Thermal Engineering* 2026, *298*, 131095, doi:10.1016/j.applthermaleng.2026.131095.
10. **Wang, Z.; Yang, Y.; Gao, J.; Cao, C.; Duan, P.** Recent Progress in the Life Cycle Assessment and Technoeconomic Analysis of Microalgae Culture and the Preparation of Sustainable Aviation Fuel. *Biomass and Bioenergy* 2026, *206*, 108682, doi:10.1016/j.biombioe.2025.108682.
11. **Rosli, M.A.F.; Ismael, M.A.; Aziz, A.R.A.; Mohammed, S.E.; A.b., O.; Opatola, R.A.** Experimental Study of Gas-To-Liquid (GTL) and Diesel Fuel Blends Evaporation Behaviour and Droplet Lifetime through Leidenfrost Effect. *Energy Reports* 2023, *10*, 805–818, doi:10.1016/j.egyr.2023.07.037.

12. **Karimi, M.; Kheiralipour, K.; Khoobbakht, M.** Eco-Friendly Diesel Fuels: How Biodiesel-Ethanol Blends Cut Emissions without Sacrificing Power. *Energy* 2026, *342*, 139430, doi:10.1016/j.energy.2025.139430.
13. **Brynolf, S.; Taljegard, M.; Grahn, M.; Hansson, J.** Electrofuels for the Transport Sector: A Review of Production Costs. *Renewable and Sustainable Energy Reviews* 2018, *81*, 1887–1905, doi:10.1016/j.rser.2017.05.288.
14. **Moonsin, P.; Roschat, W.; Phewphong, S.; Watthanalao, S.; Chaona, P.; Maneerat, B.; Arthan, S.; Thammayod, A.; Leelatam, T.; Duanguppama, K.; et al.** The Physicochemical Characterization of Diesel-like Fuels Derived from Plastic Waste Pyrolysis. *Journal of the Taiwan Institute of Chemical Engineers* 2025, *171*, 106040, doi:10.1016/j.jtice.2025.106040.
15. **Ismael, M.A.; Rosli, M.A.F.; Aziz, A.R.A.; Mohammed, S.E.; Opatola, R.A.; El-Adawy, M.** Gas to Liquid (GTL) Role in Diesel Engine: Fuel Characteristics and Emission: A Review. *Cleaner Engineering and Technology* 2024, *18*, 100706, doi:10.1016/j.clet.2023.100706.
16. **Bonalumi, D.; Tabrizi, M.K.; Famiglietti, J.; Bua, L.; Gioco, G.** The Carbon Footprint of Hydrotreated Vegetable Oil (HVO) Production and Consumption Based on Primary Data. *Journal of Cleaner Production* 2026, *558*, 148058, doi:10.1016/j.jclepro.2026.148058.
17. **Chen, H.; Zhang, Y.; Luan, X.; Zhang, M.** Guanzhen TaoExperimental Analysis and Modeling of Ethanol-Biodiesel-Diesel Blends Injection Behavior. *Fluid Dynamics and Materials Processing* 2025, *21*, 1753–1770, doi:10.32604/fdmp.2025.066494.
18. **Rahman Adib, A.; Mizanur Rahman, Md.; Hassan, T.; Ahmed, M.; Al Rifat, A.** Novel Biofuel Blends for Diesel Engines: Optimizing Engine Performance and Emissions with *C. Cohnii* Microalgae Biodiesel and Algae-Derived Renewable Diesel Blends. *Energy Conversion and Management: X* 2024, *23*, 100688, doi:10.1016/j.ecmx.2024.100688.
19. **Rennuit-Mortensen, A.W.; Dalgas Rasmussen, K.; Grahn, M.** How Replacing Fossil Fuels with Electrofuels Could Influence the Demand for Renewable Energy and Land Area. *Smart Energy* 2023, *10*, 100107, doi:10.1016/j.segy.2023.100107.
20. **Karaba, A.; Le, T.A.; Patera, J.; Suková, M.; Suchopa, R.; Herink, T.; Zámostný, P.** Waste Plastic Pyrolysis Oils Are Promising Feedstock for Sustainable Monomers Production via Steam Cracking Process. *Journal of Analytical and Applied Pyrolysis* 2025, *186*, 106950, doi:10.1016/j.jaap.2025.106950.
21. **Wu, Q.; Chen, L.; Qin, S.; Liu, R.; Yuan, C.** Linear Vibration Combustion Generation and Nonlinear Coupling Dynamics in DI-HCCI Systems: A Quadruple Fuel Blend Analysis of FAME, DME, Diesel, and Ethanol. *Applied Thermal Engineering* 2025, *280*, 128512, doi:10.1016/j.applthermaleng.2025.128512.
22. **Smigins, R.; Sondors, K.; Pirs, V.; Dukulis, I.; Birzietis, G.** Studies of Engine Performance and Emissions at Full-Load Mode Using HVO, Diesel Fuel, and HVO5. *Energies* 2023, *16*, 4785, doi:10.3390/en16124785.
23. **Dimitriadis, A.; Natsios, I.; Dimaratos, A.; Katsaounis, D.; Samaras, Z.; Bezergianni, S.; Lehto, K.** Evaluation of a Hydrotreated Vegetable Oil (HVO) and Effects on Emissions of a Passenger Car Diesel Engine. *Front. Mech. Eng.* 2018, *4*, doi:10.3389/fmech.2018.00007.
24. **Shepel, O.; Matijošius, J.; Rimkus, A.; Duda, K.; Mikulski, M.** Research of Parameters of a Compression Ignition Engine Using Various Fuel Mixtures of Hydrotreated Vegetable Oil (HVO) and Fatty Acid Esters (FAE). *Energies* 2021, *14*, 3077, doi:10.3390/en14113077.
25. **Ushakov, S.; Halvorsen, N.G.M.; Valland, H.; Williksen, D.H.;** Æsøy, V. Emission Characteristics of GTL Fuel as an Alternative to Conventional Marine Gas Oil. *Transportation Research Part D: Transport and Environment* 2013, *18*, 31–38, doi:10.1016/j.trd.2012.08.007.
26. Media, F. Papildytas Lietuvos kariuomenės automobilių parkas – į tarnybą išvažiuoja beveik 150 sunkvežimių Unimog U5000 | Lietuvos kariuomenė Available online: https://www.kariuomene.lt/papildytas-lietuvos-kariuomenes-automobiliu-parkas-i-tarnyba-isvaziuoja-beveik-150-sunkvezimiu-unimog-u5000/22695 (accessed on 13 June 2026).
27. OM 366 LA Available online: https://mercedes-benz-publicarchive.com/marsClassic/en/instance/picture/OM-366-LA.xhtml?oid=186386169 (accessed on 13 June 2026).
28. Unimog Specifications | Atkinson Vos Available online: https://www.unimogs.co.uk/buying-advice/buying-guides/unimog-specifications (accessed on 13 June 2026).
29. Media, F. Daugiafunkcinis sunkvežimis SISU E13TP | Lietuvos kariuomenė Available online: https://www.kariuomene.lt/ginkluote/sausumos-transporto-priemones/daugiafunkcinis-sunkvezimis-sisu-e13tp/22886 (accessed on 13 June 2026).
30. Mercedes-Benz Arocs 4142 AK 8x6 (2012 - 2026) Truck Specs & Dimensions | LECTURA Specs Available online: https://www.lectura-specs.com/en/model/transportation/trucks-rigid-chassis-mercedes-benz/arocs-4142-ak-8x6-11727461 (accessed on 13 June 2026).
31. The King of All Trucks: Mercedes Zetros 3643 AS 6x6 - MercedesBlog Available online: https://mercedesblog.com/king-trucks-mercedes-zetros-3643-6x6/ (accessed on 13 June 2026).