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The Effect of Biofuel on the Economic and Environmental Efficiency of Marine Diesel Engines

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Introduction

European nations are consistently improving their infrastructure and transportation systems, which includes inland and maritime transportation. European shipping companies, like Maersk in Copenhagen, Denmark, Mediterranean Shipping Company in Geneva, Switzerland, and, construct or purchase modern ships from Asian shipyards that are compliant with American and European classification societies' standards and are capable of sailing in any oceanic water body These ships' power units have a capacity of, and they have a top speed of knots. Turbine units, gas turbine units, and internal combustion engines are utilised as heat engines in seagoing and inland water transport vessels on sea tankers and other vessels, steam turbine plants. On passenger ships, gas turbine units often replace auxiliary engines and supply electrical energy to ship customers. Regardless of their type or deadweight, all ships have diesel engines installed, which act as both the main and auxiliary engines in the first scenario, their power assures the ship's motion; in the second scenario, generators transform their useable mechanical energy into electrical energy, ensuring the operation of the ship's auxiliary mechanisms and systems.

Description

The following alternative fuels are now utilised and aggressively promoted on marine vessels. In terms of stationary energy, natural gas comes in first place among alternative fuels. Methane, also known as CH4, makes up 85–95% of modern liquefied natural gas with the remaining 5% consisting of ethane, propane, butane, and nitrogen. A little over is the lower caloric value. When the stoichiometric ratio of is surpassed, the gas won't be sufficient to start a fire; if it is less than 5, there won't be as much oxygen in the mixture. Using the liquefied natural gas requires regasification, which is evaporation without access to air. Due to the requirement for additional fuel tanks, these results in a rise in its specific volume, which limits the feasibility of its usage [1].

Methanol and ethanol blends with diesel fuel have a density of 790–800 kg/m3 at 20 °C. This enables their delivery to the diesel cylinder using fuel pumps and injector nozzles intended for the primary fuel Methanol and ethanol are both extremely hazardous flammable liquids in their purest form, with a flash point of 7–10 °C and an ignition temperature of 12–, respectively. Methanol has a lower caloric value (between 22,500 and 23,000 kJ/kg), but its gains over diesel fuel are offset by its higher combustion rate, full combustion, and lower heat losses. Pure methanol and ethanol, however, are exclusively utilised as fuel in diesel automobile engines. Blends of petroleum fuel, methanol, and ethanol must undergo continuous hydrodynamic treatment [2].

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Artificial liquid fuel with biological origins is one of the popular and promising types of alternative fuel (biofuel). known as methyl esters of fatty biodiesel fuel is produced from a variety of sources, most notably rapeseed, plants, and used cooking oil. The availability of vast quantities of raw materials is a benefit of using biodiesel fuel. Diesel and biodiesel can be combined or used separately. Additionally, it should be noted that the use of alternative fuels is restricted for high-power marine diesel engines (with cylinder diameters greater than rated powers greater than 5000 Kw because doing so results in uncontrollable environmental performance degradation and a reduction in effective power at the rated load [3].

Marine boats' internal combustion engines release harmful substances into the atmosphere in addition to providing electricity for the ship and its auxiliary equipment. Additionally, the world's stocks are diminished by the usage of petroleum fuel in marine diesel engines. The use of alternative fuels is a choice that, on the one hand, helps limit the emission of hazardous substances and, on the other hand, reduces the usage of natural oil resources. biodiesel fuel is a substitute fuel that can be utilised with marine diesel engines. Along with the, and China, numerous nations also produce these fuel grades. This opens up the possibility of bunkering biofuel in ports throughout the world. Utilizing a blend of biodiesel and diesel fuel increase ecological and economic qualities. The major finding indicated a reduction in nitrogen and carbon oxide emissions. This, in our opinion, is caused by the biofuel's higher hydrogen content and lower flash point (as compared to diesel fuel). By doing so, the maximum temperature in the diesel cylinder is lowered and the production of is stopped in its tracks. This is particularly significant in light of recent international and national convention regulations. For each diesel engine load, it is possible to determine experimentally the optimum biofuel concentration in the fuel mixture at which the highest reduction in NOX and CO emissions is provided. This concentration is dependent on the stoichiometric ratio [4,5].

Conclusion

The fuel mixture can be composed primarily of the diesel fuel it already contains (80–95%); the remaining portion will be biodiesel. Using specialised dosing equipment, it is simpler to mix diesel and biodiesel right before injection. The system will automatically add the required amount of biodiesel, and the mixture will be prepared before injection. The injection of the fuel mixture through a single nozzle is made possible by the close or equivalent viscosity and density of biofuel and diesel fuel. No new biofuel feeding system to the diesel engine cylinder needs to be installed. It is advisable to use a fuel combination efficiently based on economic and environmental considerations.

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Conflict of Interest

None.

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