Green fuel as alternative fuel for diesel engine: A review

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\textbf{A B S T R A C T}

Green fuels also called green hydrocarbons, biofuels, are fuel produced from biomass sources through a variety of biological and thermochemical processes. These products are similar to petroleum gasoline and diesel fuels and are therefore considered fully infrastructure compatible fuels. They can be utilized in engines without engine modification. This paper presents a comprehensive review on the potential of biodiesel from different waste feedstock biodiesel such as waste cooking oil and waste plastic oil. Furthermore, the effect on the engine performance, combustion and exhaust emissions including details of engine and operating condition also review in this paper. The main goal of this paper is to provide information to the engineers, industrialists and researchers who are interested on waste biodiesel and to prominence waste biodiesel as a promising alternative replacement for fossil fuels. A large number of literatures from highly rated journals in scientific indexes are reviewed including the most recent publications.

\textbf{1. Introduction}

Global warming has become an issue of some concern over the last couple of decades. According to the environmental protection agency (EPA), global warming is defined as the recent and ongoing rise in earth surface temperature [1–3]. Its effects can be clearly seen as an increase in extreme weather events, warming of the oceans, disappearing glaciers and polar ice, damaged coral, and wildlife distributions, changes in health, and increased activity and abundance of disease vectors. On 12 November 2015, NASA scientists reported that human-made carbon dioxide (CO\textsubscript{2}) continues to increase above levels not seen in hundreds of thousands of years. The International Energy Agency (IEA) forecasts that the emissions of CO\textsubscript{2} from transport sector will increase by 92\% between 1990 and 2020 and it is estimated that 8.6 billion metric tons carbon dioxide will be released to the atmosphere from 2020 to 2035 [4–6]. Currently, about half of the carbon dioxide released from the burning of fossil fuels is not absorbed by plants and the oceans and it remains in the atmosphere [7]. Human activities since the beginning of the Industrial Revolution (taken as the year 1750) have produced a 40\% increase in the atmospheric concentration of CO\textsubscript{2}, from 280 ppm in 1750–400 ppm in 2015 [8,9]. This increase has occurred despite the uptake of a large portion of the emissions by various natural "sinks" involved in the carbon cycle. Anthropogenic CO\textsubscript{2} emissions come from combustion of carbon-based fuels, principally coal, oil, and natural gas, along with deforestation, soil erosion and animal agriculture [10]. The reason fossil fuels are a problem for global warming is that they are releasing additional carbon that had been sealed away in the Earth’s long-term storage, away from our ecosystem. This means that burning them increases the total amount of carbon dioxide circulating through our ecosystem. In 2013, Li [11] observed that extracted fuels and use of fossil fuel is the main contributor to the greenhouse effect emission which is result to the global warming and the consequent climate change.

Energy crisis happened in the past decades due to the substantial reduction of exhaustible resources like fossil fuels. Research 2008 done by Baruch [1] observed that the rising population there is growing demand in products and services as economic development is accelerated which translates to an increased energy demand, which is projected to double by 2050. This means that in the years to come, the world's population is projected to increase and so is the demand in energy, which is in a paradoxical state with the fact that the traditional fossil fuels are finite in abundance [12]. Currently world facing two critical issues which are increased environmental degradation and depletion of fossil fuel.

Transportation system has a great importance for social and economic development of any country. It is contributes significant amount of greenhouse emission particularly in the developing and developed countries. The maximum amount of greenhouse gases added to the atmosphere are from electricity and transportation sectors and the corresponding values are 34\% and 27\% [13]. The rising issue for

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