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Research Paper

# THERMAL AND VIBRATION ANALYSIS OF CI ENGINE USING DIESEL AND WASTE COOKING OIL BIODIESEL BLENDS

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### Abstract

Compression Ignition (CI) engines can operate on blend of diesel, and waste cooking oil biodiesel (WCOBD). In order to reduce the consumption of diesel, a rapidly depleting fossil fuel, can be replaced with WCOBD, which was derived from waste cooking oil (WCO). To support this, an experimental analysis is carried out on combustion, performance, emission and vibration characteristics of CI engines using blends of diesel and WCOBD. As a result, the WCOBD is recommended to replace the diesel partially in order to address the issues raised due to large usage of diesel and re-use of cooking oil. The large usage of diesel causes pollution. Similarly, the re-use of cooking oil leads to severe health issues such as cancers and lungs related diseases. The diesel and blend of diesel and WCOBD such as BD10 (Blend of 90% diesel and 10% WCOBD), BD20, BD30 and BD40 are used as fuels in the test engine. According to the experimental results, at full load and 1500 RPM, the Brake Thermal Efficiency (BTE) of the engine utilizing BD20 is 32.36%, with a Rate of Pressure Rise (RPR) of 4.48 bar/<sup>0</sup>CA. Further increase in WCOBD% resulted in decreased BTE. At BD20 CO and HC emissions decreased marginally. In comparison to other fuels, BD20 has a reduced vibration acceleration i.e., 0.10 m/s<sup>2</sup>. Therefore, it can be inferred that the engine without any modifications can operate on BD20 blend as it has a modest BTE, RPR, and low vibration and low emission as compared to other WCOBD blends.

### Introduction

Diesel is a non-renewable rapidly depleting fossil fuel. As the power and automobile sectors depend on it, the massive and ongoing consumption of diesel in these sectors results in environmental pollution and contributes to global warming. Thus, there is a need to search for an alternate and renewable fuel [1]. In this view, the researchers focused on utilization of biodiesel (BD) as an alternate fuel [2], [3]. The utilization of these fuels by the CI engines helps in reducing the re-use of repeatedly heated cooking oil. This leads to minimization of health issues including various types of cancers [4]. The WCO is used to produce BD by