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# Brake Thermal Efficiency Enhancement of Chicken Waste Based Biodiesel Using $\text{Al}_2\text{O}_3$

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**ABSTRACT:** This project focuses on the performance analysis of chicken waste biodiesel with diesel. Experiments are conducted at different ratios of chicken waste biodiesel-diesel blends such as B10 (biodiesel 10% & diesel 90%), B20 (biodiesel 20% & diesel 80%), B30 and compared with diesel (B00-100% diesel). The results were analyzed to find out the optimum fuel blend ratios and that fuel blend ratio is added with nanoparticles ( $\text{Al}_2\text{O}_3$ ) additives to check for increasing performance.

## I. INTRODUCTION

In the current scenario, the use and cost of fossil fuels are increasing day by day. Despite the increasing cost, environmental issues are very concerning; pollution caused by this fuel is destroying the ecosystem. Thus, there is a need to search for alternative fuels in place of fossil fuels. Different technologies are presently established for producing alternative fuels, which might take the place of petroleum such as waste plastic biodiesel, jatropha biodiesel, rubber seed biodiesel, chicken waste biodiesel, and so on. Also, we are looking for a way to tackle the issue of leftover chicken wastes where we have the chicken waste biodiesel as an alternative fuel that to be blended with diesel which can be used in the existing diesel engine without any alterations. For increasing the performance and reducing the emissions additives can be added. Here we are adding alumina nanoparticles for checking its effect in diesel-biodiesel blends.

## II. PROJECT DESCRIPTION

The first step is to extract the biodiesel from the chicken slaughter waste. Through the dry rendering process the chicken slaughter waste is converted into rendered chicken oil (RCO). This RCO is converted into biodiesel in a two-step chemical reaction called acid-catalyzed esterification of fatty acid and base-catalyzed transesterification of triglycerides. At the end of transesterification biodiesel and glycerol are formed.

In acid-catalyzed esterification, the free fatty acid is reacted with methanol and  $\text{H}_2\text{SO}_4$  at  $60^\circ\text{C}$  for a reaction period of 90 minutes which completely reduces the FFA value to a minimum value. In base-catalyzed transesterification, the triglycerides react with methanol in presence of NaOH catalyst at  $60^\circ\text{C}$  for 120 minutes producing biodiesel (83.04%) and glycerol (16.96%). Then the biodiesel is washed with a 50-volume percentage of 0.2wt%  $\text{H}_2\text{SO}_4$  until the pH of water added for washing becomes equal to the water obtained after washing (deionized water).

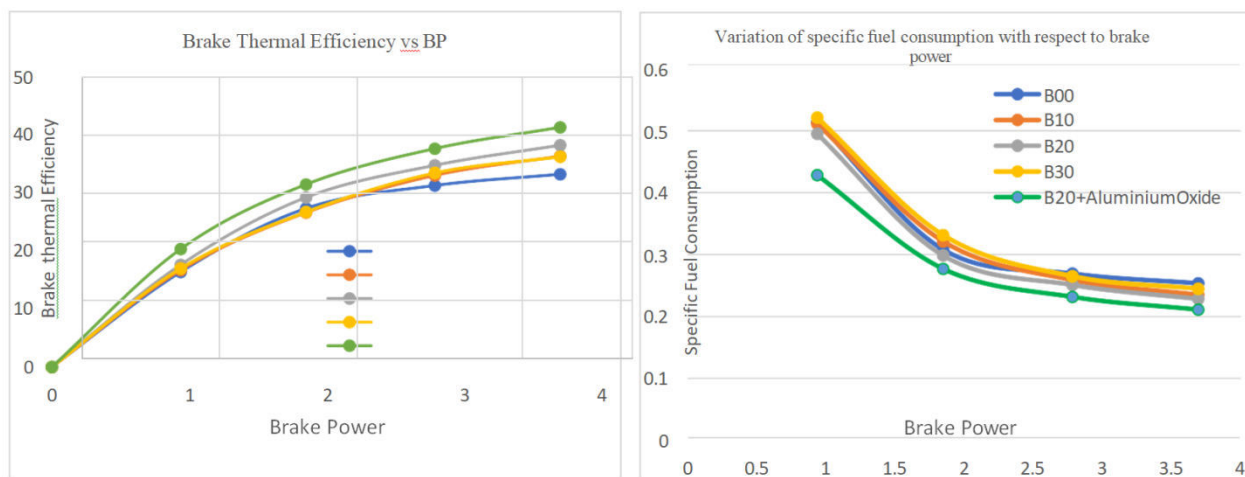
Biodiesel diesel blends are prepared by the volume method as they have almost similar properties so they can be blended directly and mixed with the help of a magnetic stirrer. B10, B20, and B30 blends are prepared and the tests are conducted on single-cylinder water-cooled diesel engine manufactured by Kirloskar for finding out the efficient blend ratio with better performance and reduced emission characteristics by comparing with B00 (100% diesel).

A number of additives have been tried by different researchers for improving the performance and reducing the emission of diesel-biodiesel blends. Among the fuel additives, nanoparticles as an additive have a promising and utmost improvement in performance and reduction in exhaust emission. Here alumina nanoparticles are chosen as additives due to their ability to reduce the emission significantly. The large surface area of alumina nanoparticles helps to increase fuel mixing during combustion. Higher oxygen content in alumina acts as an oxygen buffer during combustion. By adding  $\text{Al}_2\text{O}_3$  its viscosity is reduced and the cetane number will be improved. This will reduce the ignition delay and results in incomplete combustion.

The performance analysis test was conducted on the above-mentioned diesel engine at a compression ratio of 17.5. Eddy current dynamometer is connected with the engine for applying load. The engine can bear a maximum load of 15kg. The test is conducted by varying load [first condition - no load, second condition - 3.8 kg (25% of max load), third condition - 7.5 kg (50% of max load), fourth condition - 11.3 kg (75% of max load) and at last condition - 15kg (100% of max load)] at a constant speed of 1500 rpm. Time for the consumption of 5cc fuel is recorded for

obtaining certain engine parameters such as brake power, brake thermal efficiency, and specific fuel consumption. The emission characteristic is obtained by using a device called AVL DIGAS 444N gas analyzer with a smoke meter. The engine was made to run for 10 min to allow stabilization before the readings were recorded. Each test was repeated 3 times and average values were taken to improve their liability. The obtained data are analyzed, plotted, and compared with commercial diesel (B00-100% diesel).

The observation obtained is displayed in the graph shown below



The result clearly showed us that the biodiesel diesel blends show a performance increase when compared to the commercial diesel. Out of which the B20 was found to be the most effective blend from the batch with remarkable improvements in performance and emission characteristics. Since the alumina nanoparticles were added to the B20 blend. It has been observed that the addition of alumina nanoparticles has significantly increased the brake thermal efficiency to 24.5% and the specific fuel consumption has been reduced by 17.64% than the commercial diesel.

### III.CONCLUSION

The B20 blend has shown better performance characteristics and reduced emission characteristics than the commercially available diesel. Since it can be used as an alternative fuel in existing diesel engines without any modifications. The addition of alumina nanoparticles significantly increased the performance characteristics Increased brake thermal efficiency and reduced specific fuel consumption. So, it can be concluded that chicken waste biodiesel B20 (biodiesel 20% & diesel 80%), blended with  $Al_2O_3$  increases performance characteristics

### REFERENCES

- [1] John Abraham, Ramesh Saravana Kumar, Francis Xavier, Deepak Mathew, Mathew, "Biodiesel production from broiler chicken waste", 2015
- [2] Prabu, "Nanoparticles as additive in biodiesel on the working characteristics of a diesel engine", 2017.
- [3] Avinash Kumar Agarwal, Sungwook Park, Atul Dhar, Chang Sik Lee, Suhan Park, Tarun Gupta, Neeraj K Gupta, Gupta, "Experimental and computational studies on Spray, Combustion, Performance and Emission characteristic of biodiesel fueled engine", 2018
- [4] Biju Cheriahan Abraham, Georgekutty S Mangalathu Sunny K George, George, "Prospective of Chicken Fat Biodiesel as a Fuel for Diesel Engines", 2021
- [5] Prisle Varghese Mathew, Rony Thomas Murickan, Jubey Joseph, Vipin Vijayan, "Investigation of Emission Properties and Performance Characteristics of Biodiesel from Chicken Waste", 2017
- [6] Mohammed S Gad, Sayed M Abdel Razeq, PV Manu and Simon Jayaraj, "Experimental investigations on diesel engine using alumina nanoparticle fuel additive", 2021.
- [7] T.E. Odetoeye, J.O. Agu, E.O. Ajala Biodiesel production from poultry wastes: waste chicken fat and eggshell (2020)



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