



**“Pilot Scale Optimization of Parameters for Quality Biodiesel
Production Using Waste Vegetable Oil”**

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A PROJECT REPORT

BY

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ABSTRACT

Owing to the fast-depleting natural resources of the world, it has become mandatory for man to come up with, and, more importantly, utilize alternate sources of energy. This would not only serve the purpose of catering to our daily needs but would also ensure that we save the earth's natural resources for future generations. Keeping this in mind, years of research has led to the development of Biodiesel as an alternative fuel. Biodiesel is a biofuel which can be made from a variety of methods but in this project we aim only at its manufacture from Waste Cooking Oil, thus, recycling the waste oil as well.

This project was divided into 3 phases.

During the 1st phase, optimization of the parameters was carried out at lab scale using Factorial Design of Experiments using Design Expert Software. Design Expert Software was used for designing the experiments. Based on the design, experiments were carried out to optimize the parameters. The trans-esterification efficiency was determined for various process conditions. The parameters that were studied included catalyst concentration, alcohol-oil ratio and temperature. During the 2nd phase, scale-up and pilot scale studies were carried out. The scale-up was carried out in an indigenous built pilot plant. Fine tuning of parameters was carried out at the pilot scale for optimum trans-esterification efficiency. The 3rd phase involved testing the quality of biodiesel to meet ASTM standards. Experimental Investigation of quality assessment involved determining the Yield%, Viscosity, Specific Gravity, Pour-Point, Calorific Value, Saponification Value and Flash Point of the product.

The parameters of molar ratio, temperature and catalyst% were optimized to 1:5, 60°C and 0.75% respectively. The yield obtained from trials run at these sets of values ranged from 96% to 98%. The quality assessment of the sample was carried out and the values for each characteristic obtained were checked to fall within the standards specified by ASTM for Biofuels. Cost incurred for production, excluding electricity was Rs. 30, thus, making the process cheap and advantageous.