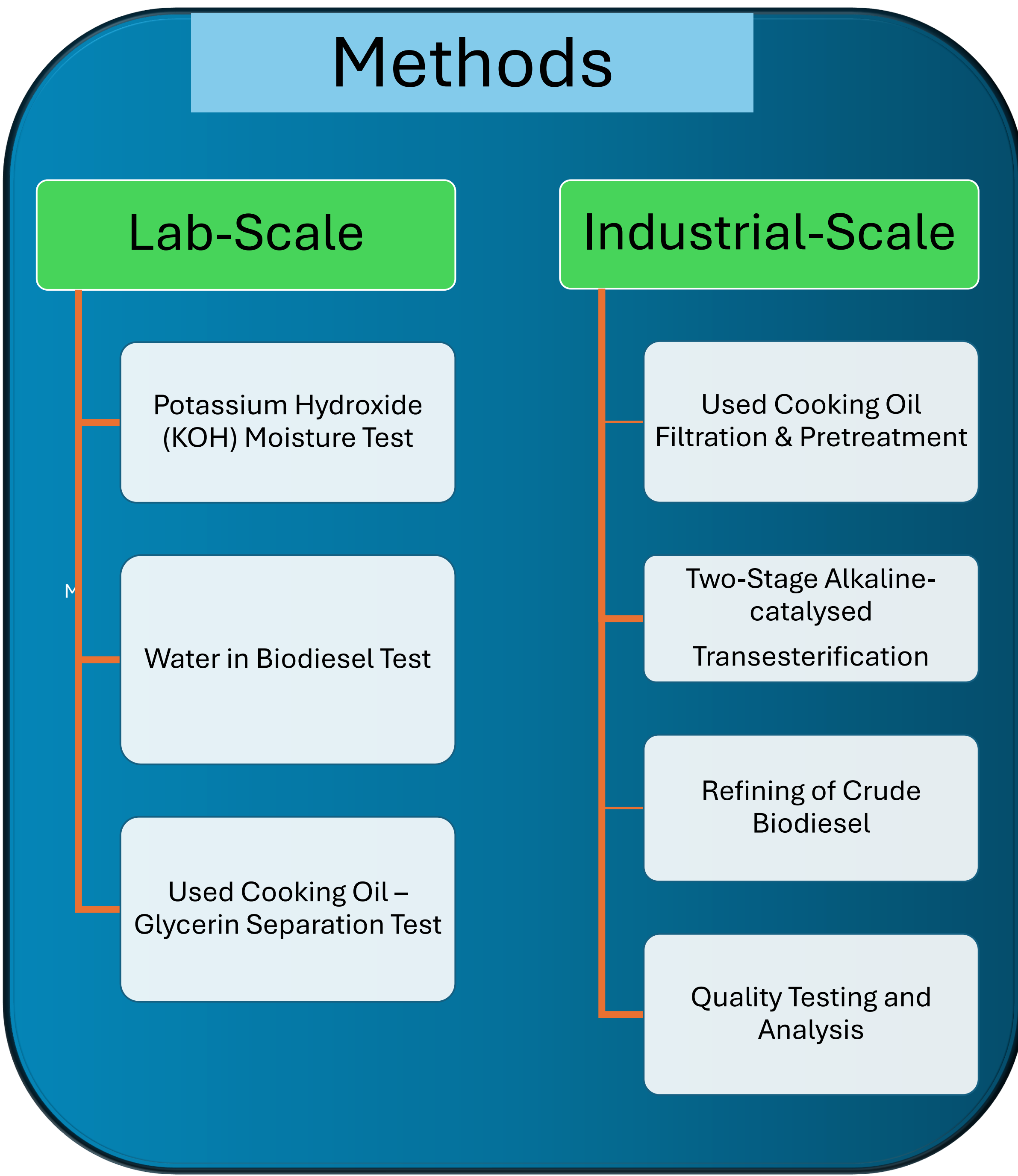


Abstract

Biodiesel produced from used cooking oil (UCO) has been extensively investigated in biofuel research and has been found to be a feasible product in many countries, except Papua New Guinea (PNG). The aim of this study was to systematically investigate the feasibility of the production of quality biodiesel from UCO under normal climatic conditions of Port Moresby (POM) in PNG. Specifically, the quality of the biodiesel produced from UCO in POM was compared to the American Society for Testing Materials (ASTM) D6751 standards to identify optimal conditions. Two experiments were conducted in this study. The first experiment was a laboratory-scale experiment that involved three tests against the climatic conditions of Port Moresby (POM) in PNG namely; potassium hydroxide (KOH) test, water in biodiesel test, and UCO and glycerin separation test. The second experiment was an industrial-scale experiment in authentic settings that included the production of biodiesel from UCO collected in POM, and the testing of the water content parameter from the biodiesel produced from UCO. The two-stage alkaline-catalysed transesterification technique was used, with methanol as the alcohol and KOH as the catalyst, under normal reaction temperatures, depending on the climatic conditions at the time of production. Overall, the results indicated a high-water content in the biodiesel, likely due to the high humidity in the PNG climate. Additionally, the heavy phase and UCO mixture cannot be separated by gravity under normal climatic conditions in POM. Further testing revealed that decreasing the drying temperature resulted in an increase in the water content of the biodiesel, which significantly exceeded the maximum limit specified in the ASTM D6751 standard.

Keywords: Humidity, Used Cooking Oil, ASTM D6751, drying temperature, water content.

Methods



Results

This study showed four major results as follows:

Impact of Humidity on KOH
KOH melted rapidly under humid conditions at 30.25°C temperature and 62.25% humidity during Experiment 1.

Biodiesel Moisture Absorption
Biodiesel samples showed hygroscopic behaviour, absorbing moisture and becoming cloudy when exposed to the atmosphere.

Separation Challenges
UCO and glycerine mixture could not be separated by gravity, suggesting the need for higher temperatures or alternative methods.

Drying Temperature Effects
Drying below 40°C resulted in water content exceeding ASTM limits, emphasizing the need for optimised drying techniques.

Conclusion

The feasibility of producing biodiesel from used cooking oil (UCO) in Port Moresby, Papua New Guinea, has been demonstrated through empirical research, highlighting both opportunities and challenges. While the tropical climate and high humidity accelerate the melting of potassium hydroxide and increase moisture absorption in biodiesel, complicating its storage and quality control, the study confirms that biodiesel production is viable with appropriate adjustments. These include optimising drying temperatures and refining separation methods to meet international standards such as ASTM D6751. The findings support the development of localised biodiesel standards and policies that promote environmental sustainability, energy independence, and alignment with PNG’s Vision 2050. Economically, utilising UCO reduces waste and offers a cost-effective energy source, while also contributing to public health by mitigating pollution from improper oil disposal in urban areas.

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