The Status of Coconut Methyl Ester as an Alternative Fuel as Assessed by Motorists in Selected Cities in Laguna: Basis for Innovation

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Abstract
This study evaluated the effectiveness of coconut methyl ester (CME) as an alternative fuel blended with diesel, as perceived by motorists in selected cities in Laguna. Effectiveness was assessed in terms of price, fuel consumption, health impact, engine performance, and smoke emission, while satisfaction was measured across tangibles, reliability, responsiveness, assurance, and price. Using a descriptive research design, data were gathered from 250 respondents composed of drivers, operators, and local government personnel through a validated questionnaire. Results indicate that CME-blended diesel is perceived as effective across all performance indicators, with no significant differences between respondent groups in most domains except health and smoke emission. Respondents also expressed overall satisfaction, although concerns were identified regarding service delivery, product awareness, and maintenance. The findings suggest that CME is a viable renewable fuel alternative, but public education, technical training, and regulatory support are essential to optimize its implementation. The Philippines currently mandates a nationwide 3% CME biodiesel blend in diesel fuel, reinforcing its national renewable energy strategy.

Keywords: coconut methyl ester; biodiesel; alternative fuel; motorists; renewable energy; sustainability

1. Introduction

The increasing volatility of global petroleum markets, coupled with climate change concerns, has intensified interest in renewable fuel alternatives. Biodiesel derived from vegetable oils is widely recognized as a viable substitute for conventional diesel due to its biodegradability, lower sulfur content, and improved combustion properties.

In the Philippines, coconut methyl ester (CME) has been integrated into the national energy mix under the Biofuels Act. As of 2024, the country mandates a 3% CME blend in diesel fuel nationwide. CME is known for its high cetane number, enhanced lubricity, and reduced particulate emissions.

While policy implementation is in place, successful adoption depends largely on user acceptance and perceived performance. Motorists, as primary end-users, influence the long-term viability of biodiesel integration. This study therefore investigates motorists' assessment of CME-blended diesel effectiveness and satisfaction levels.

2. Literature Review

2.1 Biodiesel and Engine Performance

Prior studies confirm that biodiesel blends improve combustion efficiency and reduce harmful emissions. CME, in particular, exhibits favorable properties such as higher cetane number and near-zero sulfur content. Studies involving public utility vehicles in the Philippines show improved mileage and reduced smoke opacity when using CME blends.

2.2 Environmental and Economic Implications

Biodiesel contributes to energy diversification and reduces dependence on imported fossil fuels. Renewable fuel adoption also stimulates agricultural value chains, particularly in coconut-producing regions.

Research involving public utility vehicles using CME blends reported increased mileage and reduced operational costs. Biodiesel's molecular structure, particularly fatty acid methyl esters, contributes to enhanced lubricity and improved engine performance.

Renewable fuels also play a vital role in sustainable development by promoting energy independence and reducing reliance on imported petroleum. National renewable energy programs emphasize expanding indigenous resources to achieve long-term environmental and economic stability.

Compared with other biodiesel feedstocks, coconut-derived biodiesel exhibits advantageous physical and chemical properties due to its medium-chain fatty acid composition. These characteristics enhance fuel solvency, detergency, and combustion efficiency. Previous experimental studies using various CME blend ratios consistently demonstrate improved engine performance and reduced emissions.

3. Theoretical Framework

This study is grounded in two complementary theoretical perspectives:

Technology Acceptance Theory posits that perceived usefulness and performance influence user adoption of innovations. Applied to alternative fuels, motorists' perceptions determine their willingness to use biodiesel blends.
Service Quality Theory (SERVQUAL Model) explains customer satisfaction through dimensions such as tangibles, reliability, responsiveness, assurance, and empathy. These constructs guided the evaluation of motorists' satisfaction with CME-blended diesel.

4. Methodology

4.1 Research Design

A descriptive research design was employed to document motorists' perceptions and experiences regarding CME-blended diesel.

4.2 Respondents

The study involved 250 respondents consisting of drivers, operators, and local government personnel selected through convenience sampling in selected cities in Laguna.

4.3 Instrumentation

Data were collected using a researcher-developed questionnaire composed of five sections: respondent profile, perceived effectiveness, satisfaction level, encountered problems, and proposed measures. Content validity was established through expert evaluation, and reliability testing is recommended for future replication.

4.4 Statistical Analysis

Data were analyzed using frequency distribution, percentage, weighted mean, ranking, and independent-samples t-test. A Likert scale measured agreement levels.

5. Results

5.1 Respondent Profile

Most respondents were males aged 31–40, married, high school graduates, and with ten or fewer years of professional driving experience.

5.2 Effectiveness of CME-Blended Diesel

Perceived Effectiveness

Variable	Mean	Interpretation
Price	4.21	Effective
Fuel Consumption	4.36	Effective
Health	4.71	Very Effective
Engine Performance	4.27	Effective
Smoke Emission	4.57	Very Effective
Overall	**4.42**	**Effective**

Overall effectiveness rating: **4.42 (Effective)**
Highest-rated indicator: health benefits
Lowest-rated indicator: price

5.3 Comparative Analysis

Independent-samples t-test results showed no significant differences between respondent groups for price, fuel consumption, and engine performance. Significant differences were observed for health and smoke emission assessments.

5.4 Satisfaction Level

Dimension	Mean	Interpretation
Tangibles	3.62	Satisfied
Reliability	3.86	Satisfied
Responsiveness	3.97	Satisfied
Assurance	4.48	Satisfied
Price	4.20	Satisfied

Dimension	Mean	Interpretation
Overall	**4.03**	Satisfied

Overall satisfaction rating: **4.03 (Satisfied)**
Highest dimension: assurance
Lowest dimension: tangibles

5.5 Problems Encountered

Major concerns identified include:

- insufficient fuel station information
- lack of personnel training
- inconsistent emission test results
- clogged filters and maintenance issues
- limited public awareness of renewable fuels

5.6 Proposed Measures

Respondents recommended:

- improved station signage and information systems
- training programs for fuel personnel
- stronger public awareness campaigns
- stricter fuel quality monitoring
- regular vehicle maintenance practices

6. Discussion

Findings indicate that motorists generally perceive CME-blended diesel as an effective and satisfactory fuel alternative. Positive evaluations of engine performance, health impact, and emission reduction align with previous biodiesel research. However, operational issues such as insufficient technical knowledge and low public awareness limit optimal adoption. Differences in perception between motorists and government personnel suggest varying levels of technical familiarity, underscoring the need for coordinated information dissemination and training initiatives.

7. Conclusion

CME-blended diesel is widely perceived as an effective alternative fuel among motorists in the study area. While performance indicators received favorable ratings, challenges related to service quality, technical knowledge, and maintenance remain. Addressing these concerns through education, training, and policy support can strengthen acceptance and maximize the benefits of biodiesel implementation.

8. Recommendations

- Conduct nationwide information campaigns on biodiesel benefits.
- Provide technical training for fuel station personnel.
- Strengthen fuel quality monitoring systems.
- Encourage collaborative research among government agencies and industry stakeholders.
- Undertake longitudinal studies on engine durability and long-term effects of CME blends.

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