**Exploring Biodiesel Fuel Production and Utilization in Davao City: Opportunities for Sustainable Energy and Economic Development – A Systematic Review of Literature**

Marivic O. Gubalane

ORCID Number: 0009-0005-9624-2606

Graduate School of Development Management, University of Southeastern Philippines,

Davao City, Philippines

**ABSTRACT**

This study systematically reviews the potential of biodiesel production and utilization in Davao City, emphasizing its implications for sustainable energy and economic development. Using the PRISMA framework, the review synthesizes 30 high-quality studies from peer-reviewed journals to assess economic, technological, environmental, and policy factors influencing biodiesel adoption. The findings reveal that waste cooking oil (WCO) presents a viable feedstock for biodiesel, with significant environmental benefits such as greenhouse gas emission reduction and waste management improvements. However, challenges include high production costs, inefficiencies in feedstock collection, and limited public awareness. Recommendations focus on enhancing technological innovation, implementing supportive government policies, raising public awareness, and fostering public-private partnerships to address economic and logistical barriers. This comprehensive approach aims to position Davao City as a leader in biodiesel production, contributing to global sustainability goals and regional economic growth.

**Keywords:**

Biodiesel production, Environmental Impact, Economic Development, Sustainable Energy, Alternative Fuels, Policy Intervention.

**INTRODUCTION**

Biodiesel production has emerged as a crucial solution for addressing global energy demands and mitigating environmental impacts associated with fossil fuel consumption. As a renewable biofuel, biodiesel is derived from a variety of feedstocks, including waste cooking oil (WCO), agricultural residues, and non-edible oils like Jatropha and palm oil. In the context of Davao City, the potential for biodiesel production lies in the availability of waste oils and abundant agricultural resources, which can be leveraged to promote sustainable energy solutions and economic development. Research has consistently demonstrated that biodiesel not only offers a cleaner alternative to conventional diesel fuel but also holds the promise of contributing to local economic growth by creating new industries and job opportunities (Adewuyi, 2020; Wicaksono et al., 2020).

The production of biodiesel from waste cooking oil has garnered significant attention due to its dual benefits of reducing waste and providing a renewable energy source. Studies have shown that the conversion of used cooking oil into biodiesel helps alleviate waste management problems, particularly in urban areas, while also contributing to a circular economy model (Amaya et al., 2021; Azman et al., 2021). The application of WCO as a feedstock is particularly appealing in regions like Davao City, where large amounts of waste cooking oil are generated, yet still not widely utilized for biodiesel production. This approach offers an opportunity to reduce the environmental burden of waste disposal while simultaneously supporting local energy needs and reducing dependence on imported fossil fuels.

However, the widespread adoption of biodiesel production is not without challenges. Several factors, such as feedstock availability, production costs, and technological limitations, have been identified as key barriers to the expansion of the biodiesel industry. The reliance on waste oils, for example, leads to fluctuations in feedstock supply, which can undermine the consistency and scalability of biodiesel production (Febijanto et al., 2020; Gupta, 2020). Additionally, despite the environmental and economic benefits, the high production costs of biodiesel, particularly when using food-based feedstocks like palm oil, remain a significant obstacle for many developing countries (Sani et al., 2020; Silalahi et al., 2020). This issue calls for innovative solutions, such as technological advancements in production processes and government incentives, to make biodiesel more economically competitive.

The environmental impact of biodiesel production has been a key area of focus in recent studies, with numerous research efforts evaluating the carbon footprint and ecological benefits of biodiesel. The reduction in greenhouse gas emissions and air pollutants, compared to conventional fossil fuels, is one of the major advantages of biodiesel (Aljaafari et al., 2020; Dubey et al., 2020). Moreover, biodiesel has the potential to support local environmental goals by reducing carbon emissions, especially in regions that heavily rely on traditional fossil fuels for transportation and power generation. As such, the adoption of biodiesel in Davao City can play an important role in the region’s transition to sustainable energy.

Furthermore, policy support and regulatory frameworks are essential to the successful implementation of biodiesel production and utilization. Research has shown that countries with well-defined biodiesel policies, such as Indonesia and Malaysia, have experienced significant progress in developing their biodiesel industries (Kurniawati et al., 2020; Widrian et al., 2020). Such policies, including subsidies for biodiesel production and mandates for blending biofuels with conventional fuels, can foster industry growth and create a more favorable market environment. In Davao City, the establishment of similar policy frameworks could be instrumental in overcoming existing barriers and encouraging the development of biodiesel as a sustainable energy source.

This systematic review of literature (SRL) seeks to explore the economic, technological, environmental, and policy factors influencing biodiesel production and utilization in Davao City, with a particular focus on identifying key opportunities and challenges that could support its adoption as a sustainable energy solution. The review aims to examine the feasibility of using waste cooking oil and other local feedstocks, assess the economic viability of biodiesel production, and evaluate the role of governmental policies and technological innovations in fostering a sustainable biodiesel industry in the region.

**METHODOLOGY**

This systematic review of literature (SRL) employs a rigorous and transparent process to assess the current body of knowledge on biodiesel production and utilization in Davao City. The review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure clarity and reproducibility. The primary objective is to synthesize existing research on the economic, technological, environmental, and policy factors that influence biodiesel production in Davao City, focusing on identifying both enablers and barriers to its sustainable adoption.

This review adopts a structured approach comprising four key stages: Identification, Screening, Eligibility, and Inclusion. The process is designed to ensure thorough coverage of the literature while adhering to methodological rigor, ensuring that all relevant studies are systematically evaluated and included.

**Research Design.** This study adopts a systematic literature review (SLR) methodology. A systematic review is a structured research method that aims to identify, assess, and synthesize all relevant studies on a particular topic to provide a comprehensive understanding of the existing body of knowledge. This approach ensures transparency, minimizes bias, and promotes reproducibility (Moher et al., 2015). The review follows a well-defined process, evaluating the economic, technological, environmental, and policy factors that influence biodiesel production and utilization in Davao City, based on studies obtained from prominent academic databases and grey literature sources.

The review is structured to answer the following key research questions (KRQs):

* RQ1: How effective is the "Used Cooking Oil to Biodiesel Fuel (BDF) Program" in terms of production sustainability, economic viability, and environmental benefits?
* RQ2: What is the current level of biofuels awareness and acceptability among the community and the population as a whole?
* RQ3: What policies and practices are in place to support the biofuel sector, and how can they be strengthened to reduce fossil fuel dependence and enhance carbon footprint reduction?

The search strategy for identifying relevant studies on biodiesel production and utilization in Davao City followed a systematic, multi-phase process, involving initial screening, full-text screening, eligibility assessment, and final inclusion. In the first phase, a total of 300 studies were initially identified from academic databases and grey literature sources. These studies were then screened for duplicates and preliminarily evaluated based on their titles and abstracts. After this evaluation, 120 studies remained for further assessment.

The next step involved applying exclusion criteria to refine the selection. Studies that were not directly related to biodiesel production or utilization, or did not focus on the key factors—economic (e.g., cost analysis, profitability), technological (e.g., production processes), environmental (e.g., emissions reduction, waste management), or policy (e.g., government support, regulations)—were excluded. Additionally, non-peer-reviewed articles, conference papers, and reports were discarded, along with studies published before 2004, as they were less likely to reflect the latest advancements in biodiesel technology and policy. After applying these criteria, 95 studies remained.

The eligibility phase involved a more detailed evaluation based on specific inclusion criteria. Only studies addressing biodiesel production, sustainability, and the economic, technological, environmental, or policy challenges were considered. Only studies published between 2001 and 2024 were included to ensure the research was current and relevant to the study’s focus on biodiesel production and utilization. Furthermore, only studies published in English were eligible. A variety of study designs, including empirical research (both quantitative and qualitative), case studies, and government reports, were included. Priority was given to studies focusing on biodiesel production in tropical regions, particularly those addressing waste cooking oil, and those examining the economic and technological factors that could support sustainable biodiesel practices. After applying the eligibility criteria, 84 studies remained for further analysis.

In the inclusion phase, eligible studies with available full texts were scrutinized for quality and relevance, reducing the pool to 59 studies. The final inclusion phase focused on selecting studies published in peer-reviewed journals, ensuring high academic quality. As a result, 30 studies were included in the final review. The researcher conducted a thorough and systematic search using four established academic databases: Scopus, Web of Science, Google Scholar, and Semantic Scholar. These platforms are trusted sources for high-quality academic literature, guaranteeing the integrity and relevance of the selected studies for the review.

**Table 1. Distribution of Studies in Peer-Reviewed Journals and Databases**

|  |  |
| --- | --- |
| **Source** | **Number of Studies** |
| Scopus | 30 |
| Web of Science | 30 |
| Google Scholar | 30 |
| Semantic Scholar | 30 |

These databases index peer-reviewed journals, conference proceedings, scholarly books, and other academic materials recognized for their credibility and scholarly rigor. Studies lacking accessible full texts or published in non-peer-reviewed sources were excluded to maintain the integrity of the review. All research studies can be found across all sources.

Identification of Studies from Databases and Search Engine

**INCLUDED**

**ELIGIBILITY**

**SCREENING**

**IDENTIFICATION**

Records identified through database searching (n=300)

Records after duplicates are removed (n=120)

Records screened based on Title and Abstract (n=95)

Records after eligibility Criteria (n=84)

Records with available full text documents (n=59)

Records present in peer-reviewed journals and databases (n=30)

Records actually used in the synthesis (n=30)

Records excluded(n=180)

Records excluded(n=25)

Records excluded(n=11)

Records excluded(n=25)

Records excluded(n=29)

**Figure 1. Contextualized PRISMA Model Used in the Study**

By adhering to systematic and rigorous methodologies, this study ensures that only the most relevant, up-to-date, and methodologically robust literature contributes to analyzing the Biodiesel Fuel Production and Utilization in Davao City. This approach, grounded in established systematic review techniques, provides a structured framework to address the research questions and generate actionable insights for fostering Opportunities for Sustainable Energy and Economic Development in biodiesel production.

For the data synthesis, a qualitative approach was used to analyze the selected studies thematically. The synthesis focused on identifying the key determinants of biodiesel production and utilization in Davao City, several critical themes emerged from the literature. These included economic drivers such as cost reduction, profitability, and the financial feasibility of biodiesel production (Macedo, 2020; Kolakoti et al., 2020); technological drivers including innovations in feedstock processing, production efficiency, and advancements in waste cooking oil conversion technologies (Febijanto et al., 2020; Ragauskas et al., 2020); policy and regulatory drivers, such as government subsidies, tax incentives, and regulatory frameworks supporting biofuel adoption (Gupta, 2020; Kurniawati et al., 2020); social drivers like public awareness of environmental issues, consumer demand for sustainable energy, and community involvement in waste management programs (Azman et al., 2021; Amaya et al., 2021); and environmental drivers including waste reduction, carbon emissions reduction, and resource efficiency in line with global sustainability targets (Aljaafari et al., 2020; Dubey et al., 2020). The synthesis also involved examining how these various factors interact and how they either facilitate or hinder biodiesel production in the local context of Davao City.

The determinants identified in the literature reveal several key factors influencing the adoption and expansion of biodiesel production in Davao City. Economic factors like cost reduction, profitability, and the rising demand for renewable energy are significant motivators for both businesses and policymakers to invest in biodiesel production. Studies have highlighted that the cost competitiveness of biodiesel, particularly using waste oils like used cooking oil, is a key driver in fostering industry growth (Guerrero et al., 2020; Kolakoti et al., 2020). Technological factors also play a vital role, as innovations in feedstock processing and biodiesel production technologies, including waste oil conversion methods, enable more cost-effective and scalable operations (Febijanto et al., 2020). The policy and regulatory landscape is another important determinant, with government incentives and subsidies, as well as regulatory frameworks that mandate renewable fuel standards, being crucial in supporting the biofuel industry (Kurniawati et al., 2020; Macedo, 2020). Social factors, such as increasing consumer awareness about environmental sustainability, the role of public support for renewable energy initiatives, and the influence of organizational culture, help shape the public’s demand for biodiesel as a cleaner alternative to fossil fuels (Azman et al., 2021). Finally, environmental factors like reducing waste, lowering carbon emissions, and enhancing resource efficiency are key motivators for promoting biodiesel as a sustainable energy solution that aligns with both local and global environmental goals (Aljaafari et al., 2020; Dubey et al., 2020). These interconnected determinants highlight the complex, multifaceted nature of biodiesel production and utilization and underscore the need for a comprehensive, integrated approach to overcoming challenges and promoting the industry’s growth in Davao City.

**RESULTS AND DISCUSSION**

the findings from the reviewed literature are presented and discussed according to the key variables identified: Effectiveness of Used Cooking Oil Collection Systems, Environmental Impact of Biodiesel Programs, Economic Benefits and Challenges of Biodiesel Production, Public Awareness and Attitudes Toward Biodiesel Programs, and Policy and Support Mechanisms for Biodiesel Program Growth. These variables were essential in understanding the multifaceted nature of biodiesel production and utilization in Davao City, and they provide insight into both the opportunities and challenges associated with the development of biodiesel programs.

**1. Effectiveness of Used Cooking Oil Collection Systems**

Studies reviewed highlight the importance of efficient used cooking oil (UCO) collection systems in ensuring the sustainability and cost-effectiveness of biodiesel production. Macedo (2020) and Febijanto et al. (2020) emphasize that UCO collection from restaurants, households, and food processing industries is a viable feedstock for biodiesel production. In Davao City, which generates significant amounts of UCO, establishing an organized collection system is crucial to meeting production demands. However, the effectiveness of these collection systems remains a challenge, particularly due to issues such as inconsistent waste oil collection schedules, improper disposal practices, and lack of public participation. Amaya et al. (2021) suggest that public awareness campaigns and collaboration with local businesses and waste management services could improve collection efficiency and reduce contamination, which is a common issue in UCO collection. In terms of system effectiveness, Azman et al. (2021) found that communities with well-coordinated waste oil collection programs saw significant reductions in illegal dumping and improved biodiesel yield. Davao City, with its strong agricultural sector, could benefit from adopting similar community-based collection programs.

**2. Environmental Impact of Biodiesel Programs**

The environmental impact of biodiesel programs was another key area examined in the literature. Studies consistently show that biodiesel derived from waste cooking oil offers significant environmental benefits over fossil fuels. According to Aljaafari et al. (2020), biodiesel production from UCO helps mitigate the environmental impacts of oil waste disposal while contributing to a reduction in greenhouse gas emissions. The use of UCO reduces the demand for virgin vegetable oils, thus helping to conserve natural resources. In the context of Davao City, where agricultural waste and UCO are abundant, biodiesel programs present an opportunity to address environmental challenges such as waste management and air pollution. Dubey et al. (2020) further highlighted that biodiesel’s life cycle is far more sustainable, contributing to less carbon footprint compared to traditional diesel. However, Sani et al. (2020) noted that while biodiesel offers substantial environmental benefits, its overall sustainability depends on the efficiency of the entire production process, including transportation emissions related to UCO collection. Thus, biodiesel from UCO has the potential to play a critical role in supporting Davao City’s environmental sustainability goals. However, further research on lifecycle assessments and the local environmental impact is necessary to fully understand its long-term benefits.

**3. Economic Benefits and Challenges of Biodiesel Production**

The economic benefits of biodiesel production in Davao City were widely discussed in the literature, particularly regarding job creation, local energy production, and the use of local feedstocks such as UCO. Macedo (2020) and Febijanto et al. (2020) noted that biodiesel production offers new economic opportunities for small and medium enterprises in rural and urban areas alike. The use of local feedstocks like UCO reduces the reliance on imported petroleum and contributes to energy security, which can help stabilize fuel prices in the region. However, despite these potential benefits, the economic challenges of biodiesel production are significant. Guerrero et al. (2020) reported that biodiesel production is still cost-prohibitive compared to conventional diesel, primarily due to the high costs of feedstock collection, processing, and conversion technologies. Kurniawati et al. (2020) also highlighted that although biodiesel production from UCO can lower feedstock costs, inefficiencies in collection and processing technologies hinder large-scale production. In Davao City, the economic viability of biodiesel is also influenced by local market dynamics, including competition from fossil fuels, which remain cheaper for consumers. Silalahi et al. (2020) argue that government incentives and subsidies could help bridge the cost gap and support the development of the biodiesel industry.

**4. Public Awareness and Attitudes Toward Biodiesel Programs**

Public awareness and attitudes play a crucial role in the success of biodiesel programs. Studies have shown that consumer demand for sustainable energy is closely linked to public knowledge about environmental issues and alternative energy options. Azman et al. (2021) found that in areas with higher public awareness, there was greater support for biodiesel programs and a higher willingness to participate in waste oil collection. Similarly, Gupta (2020) found that when people were informed about the environmental benefits of biodiesel, they were more likely to adopt it as an alternative to fossil fuels. In Davao City, public awareness campaigns could be critical in encouraging participation in UCO collection programs and promoting the use of biodiesel. However, Amaya et al. (2021) pointed out that many people remain unaware of the benefits of biodiesel, and there is still resistance to adopting alternative fuels. Educational programs targeting schools, businesses, and local communities could increase awareness and foster positive attitudes toward biodiesel.

**5. Policy and Support Mechanisms for Biodiesel Program Growth**

Finally, policy and regulatory support mechanisms were found to be vital for the successful scaling of biodiesel programs. According to Macedo (2020), government policies such as subsidies, tax breaks, and mandates for blending biodiesel with fossil fuels have been essential in countries like Indonesia and Malaysia for fostering biodiesel production. Kurniawati et al. (2020) also emphasized that regulatory frameworks promoting the use of renewable fuels are crucial in creating a market for biodiesel. In Davao City, policies that incentivize biodiesel production could stimulate industry growth. However, Guerrero et al. (2020) and Silalahi et al. (2020) pointed out that the lack of clear national biofuel policies and inconsistent enforcement of regulations are significant barriers to the development of biodiesel in the Philippines. Sani et al. (2020) stressed that a coordinated effort from both the local government and industry stakeholders is required to overcome these barriers and promote biodiesel as a sustainable energy solution. Government support, such as incentives for biodiesel producers, tax credits for businesses that use biodiesel, and funding for research on production technologies, will be crucial for encouraging widespread adoption in Davao City. In addition, collaboration between the public and private sectors will be essential to establish efficient supply chains for feedstock collection, processing, and distribution.

### **SYNTHESIS AND IMPLICATIONS** The literature on biodiesel production in Davao City highlights several critical factors that influence its adoption and sustainability, including **economic**, **technological**, **environmental**, **social**, and **policy** drivers. Economically, biodiesel offers opportunities for local job creation and energy independence, but challenges such as high production costs and inefficiencies in feedstock collection, particularly used cooking oil (UCO), remain significant. Technologically, advancements in feedstock processing and biodiesel conversion technologies can lower costs and improve efficiency, but infrastructure improvements are needed. Environmentally, biodiesel made from UCO presents significant benefits, such as waste reduction and lower emissions, though further lifecycle assessments are needed to fully understand its environmental impact. Socially, raising public awareness and increasing consumer demand for biodiesel are essential for successful waste oil collection programs and broader adoption. Policy-wise, supportive regulations, incentives, and subsidies are crucial for fostering biodiesel growth and making it competitive with fossil fuels.

Given these findings, several implications emerge for Davao City. **Policy support** is essential to creating a favorable environment for biodiesel production, with government incentives, tax credits, and regulations that mandate biodiesel blending. **Technological investments** are needed to improve feedstock collection systems and biodiesel production processes, reducing costs and enhancing scalability. **Public awareness** campaigns are critical to educating consumers and encouraging participation in UCO collection programs, which will drive demand for biodiesel. To address the economic challenges, **public-private partnerships** and **cooperative models** for feedstock collection could help stabilize the supply chain and reduce production costs. Furthermore, conducting a more thorough **environmental lifecycle assessment** of biodiesel production will ensure its long-term sustainability. Finally, **diversifying feedstocks** beyond UCO, such as using Jatropha or algae, could reduce dependency on a single feedstock and ensure a more reliable and sustainable biodiesel supply.

In summary, biodiesel production in Davao City presents considerable potential for both environmental sustainability and economic growth. However, realizing this potential requires a multi-faceted approach that addresses technological, economic, social, and policy challenges through coordinated efforts from government, industry, and the public.

**CONCLUSION**

Biodiesel production in Davao City presents a promising opportunity to advance sustainable energy, reduce waste, and promote economic development. The literature reviewed highlights several key determinants that influence the successful adoption of biodiesel, including economic viability, technological innovation, environmental sustainability, public awareness, and supportive policies. While biodiesel offers significant environmental benefits, such as reducing carbon emissions and managing waste oils, challenges remain, particularly in terms of high production costs, technological inefficiencies, and the need for effective feedstock collection systems.

The findings indicate that a comprehensive approach involving government support, technological investments, public education, and policy development is essential to overcome these challenges. By implementing clear policies that incentivize biodiesel production, improving collection and processing technologies, raising public awareness, and diversifying feedstocks, Davao City can position itself as a leader in biodiesel production and contribute to broader sustainability goals.

Ultimately, the success of biodiesel production in Davao City will depend on a collaborative effort between the government, industry stakeholders, and the public. Addressing the existing barriers through strategic investments, innovation, and community involvement can unlock the full potential of biodiesel, ensuring it becomes a sustainable, cost-effective energy solution for the region’s future.

**REFERENCES**

* Adewuyi, A. (2020). *Production of biodiesel from underutilized algae oil: Prospects and current challenges encountered in developing countries*. Renewable Energy Reviews, 43(4), 222-234.
* Amaya, J., Coello, S., Crespo, T., Hidalgo, J., Jervis, F., Moreira, C., Soto, M. (2021). *Waste to energy potential of domestic waste cooking oil in Guayaquil: A review*. Renewable and Sustainable Energy Reviews, 56(2), 182-193.
* Azman, N. S., Che Hamzah, N. H., Khairuddin, N., Marliza, T. S., Sanusi, A., Lahuri, A. H., Siddique, M. B. M. (2021). *Promoting awareness in handling of used cooking oil for biodiesel production in Bintulu Sarawak, Malaysia*. Environmental Research Journal, 39(3), 315-325.
* Febijanto, I., Ulfah, F., Kusrestuwardhani, S., Edi Yuwono, S., Trihadi, S. (2020). *A review on used cooking oil as a sustainable biodiesel feedstock in Indonesia*. Asian Journal of Renewable Energy, 58(6), 245-257.
* Gupta, V. (2020). *An Investigative Study on the Awareness of Biodiesel and its Sustainable Impact on Environment in the City of Bengaluru*. Journal of Renewable Energy Development, 48(1), 103-112.
* Kurniawati, A. S., Pratiwi, A., Ariyani, N., Septiani, M., Sasongko, N. (2020). *Utilization of palm oil-based biofuel to support sustainable energy transition in Indonesia*. Journal of Energy Policy, 47(4), 503-510.
* Sani, Y., Daud, W. M. A., Aziz, A. (2020). *Biodiesel feedstock and production technologies: Successes, challenges and prospects*. Biofuels and Biorefining, 11(1), 97-112.
* Silalahi, F. T. R., Simatupang, T., Siallagan, M. (2020). *Biodiesel produced from palm oil in Indonesia: Current status and opportunities*. International Journal of Energy Economics and Policy, 10(4), 211-222.
* Widrian, A. F., Arifianto, B., Nurbaiti, N., Sasongko, N. (2020). *Review of biodiesel policy in Indonesia*. Policy Review Journal, 32(2), 146-158.
* Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2015). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLOS Med, 6*(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
* Azman, N. S., Che Hamzah, N. H., Khairuddin, N., Marliza, T. S., Sanusi, A., Lahuri, A. H., & Siddique, M. B. M. (2021). Promoting awareness in handling of used cooking oil for biodiesel production in Bintulu Sarawak, Malaysia. Environmental Research Journal, 39(3), 315-325.
* Aljaafari, A., Fattah, I. M. R., Jahirul, M., Gu, Y. T., Mahlia, T., Islam, M. S., & Islam, Md. A. (2020). Biodiesel emissions: A state-of-the-art review on health and environmental impacts. Renewable and Sustainable Energy Reviews, 41, 43-56.
* Amaya, J., Coello, S., Crespo, T., Hidalgo, J., Jervis, F., Moreira, C., & Soto, M. (2021). Waste to energy potential of domestic waste cooking oil in Guayaquil: A review. Renewable and Sustainable Energy Reviews, 56(2), 182-193.
* Febijanto, I., Ulfah, F., Kusrestuwardhani, S., Edi Yuwono, S., & Trihadi, S. (2020). A review on used cooking oil as a sustainable biodiesel feedstock in Indonesia. Asian Journal of Renewable Energy, 58(6), 245-257.
* Guerrero, A. F. C., Guerrero-Romero, A., & Sierra, F. E. (2020). Biodiesel production from waste cooking oil. Journal of Energy and Environmental Science, 13(5), 1125-1133.
* Kurniawati, A. S., Pratiwi, A., Ariyani, N., Septiani, M., & Sasongko, N. (2020). Utilization of palm oil-based biofuel to support sustainable energy transition in Indonesia. Journal of Energy Policy, 47(4), 503-510.
* Macedo, R. (2020). Biodiesel production from waste cooking oil: Techno-economic and environmental considerations. Energy Reports, 6, 34-42.
* Ragauskas, A., Pu, Y., & Ragauskas, A. J. (2020). Biodiesel from grease interceptor to gas tank. Energy Conversion and Management, 123, 74-85.
* Dubey, S. K., Godara, E. R. K., Dar, E. G. A., Sharma, E. S., & Kawal, E. S. (2020). A study of biodiesel as opportunities for environmental improvement. Environmental Sustainability Journal, 12(2), 76-85.