

Biodiesel Production In India: Regulatory Framework And Its Challenges

written by King Stubb & Kasiva | November 10, 2023



Introduction

With its growing population and rapid economic expansion, India has recognized the need to address the country's energy security while also reducing its carbon footprint. Biodiesel production in India has emerged as a significant strategy for achieving sustainable and renewable energy sources. Biodiesel is an eco-friendly alternative to traditional fossil fuels, sourced from biomasses like agricultural residue, wastewater, algae, extra or waste foods, etc. through processes such as fermentation, transesterification, thermochemical routes, and many other methods.[\[1\]](#)

Biodiesel adoption and production in India have been the subject of considerable policy and regulatory attention over the years. India has taken

significant steps in developing a National Biofuel Policy aimed at capitalizing on the environmental, economic, and social advantages of large-scale biofuel production.

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Biodiesel Regulations In India

Biodiesel production in India has been marked by a clear focus on ensuring sustainability by avoiding edible feedstock for bio-energy production, thus addressing the global “food vs. fuel” issue. Several policies and initiatives were established by the government in order to minimize the country’s reliance on fossil fuels and promote the expansion of biodiesel production.

1. **National Biofuel Policy (2009 and 2018):** [\[2\]](#) [\[SB1\]](#) The National Biofuel Policy (2009) outlined the vision and goals for the development of biofuels in India, including biodiesel. It aimed to facilitate the optimal development of domestic biomass feedstock for biofuel production. The revised National Biofuel Policy (2018) proposed an indicative blending target of 20% ethanol in petrol and 5% biodiesel in diesel by 2030. These measures are undertaken with the objective of reducing crude oil imports, augmenting farmers’ income, generating employment, and contributing to sustainability.
2. **First, Second, and Third Generation Biofuels:** The policies categorize biofuels into three generations:
 - First-generation (**1G**) includes conventional ethanol and biodiesel, primarily produced from food crops.
 - Second-generation (**2G**) includes ethanol from lignocellulosic biomass, non-food crops, industrial wastes, and residues.
 - The third generation (**3G**) comprises compressed BioCNG from food waste, biomass, MSW, and sewage water.
3. **Sustainable Alternative Towards Affordable Transportation (SATAT):** SATAT seeks to establish compressed biogas production units to make Compressed BioGas (**CBG**) available as a green fuel on the market. This initiative aims to encourage the use of organic waste for CBG production.

Challenges In Biodiesel Production

Biodiesel production in India comes with a set of challenges that need to be addressed to ensure the sustainability of the industry.

1. Feedstock Availability and Production Cost: While India is blessed with abundant biomass, harnessing it for biodiesel production presents challenges. A key issue is the cost involved in collecting and delivering biomass residues to biodiesel plants. A reliable supply chain covering the collection, transportation, and handling of feedstock is vital. To achieve this, cooperatives or farming communities could be incentivized to be involved in the process.

2. Quality Issues: Different species of plants produce varying quantities of oil suitable for biodiesel production. This inconsistency poses challenges for standardization and compatibility with existing engine technologies and fuel distribution systems.

3. Land Use and Nutrient Challenge: Regardless of the growth strategy employed and the efficiency of oil extraction, large-scale implementation is needed to replace a significant amount of fossil fuel, which, in turn, requires substantial land use. Additionally, algae-based biodiesel, a 3G biofuel, requires specific nutrients such as nitrogen, iron, phosphorus, and sulfur, the availability of which varies on the basis of market conditions.

4. Economic Viability: The cost of **biodiesel production in India** still remains higher than fossil fuels, impacting its economic feasibility.

5. Policy and Regulatory Support: The continuing necessity of robust policies and regulatory support can hinder the growth of the biodiesel industry in India. There's a need for mandatory blending with conventional fuels, subsidies, and incentives to create competition among bioenergy producers.

6. Pre-Treatment of Feedstock: The pre-treatment of feedstock is essential to make the carbohydrates in lignocellulosic biomass accessible for conversion. The choice of a pre-treatment method should prioritize efficiency in avoiding product degradation. This aspect directly influences production costs and the subsequent costs of enzymatic hydrolysis and fermentation. Pre-treatment constitutes a significant part of the total costs of bioethanol production, making it a crucial area for optimization.

7. Utilization of CO₂: Biodiesel production should also consider the utilization of CO₂ generated during the process. Another major challenge would be to ensure that CO₂ is utilized effectively and does not pose environmental risks.

8. Non-Edible Feedstocks: India's commitment to producing biodiesel from non-edible oil sources is a complex endeavor. The challenges in this regard include unsuitability of land for cultivation, high cultivation costs, low productivity, and inadequate availability of seeds.

Challenges In Third-Generation Biofuels: Algal Biofuel

Algal biofuel production, despite being a promising third-generation biofuel, is not without its challenges.

- 1. High Production Costs:** The production of algal biofuel remains costlier than conventional fossil fuels, giving rise to a lack of marketability with the general populace.
- 2. Water Demand:** Algae require a significant amount of water, and their growth can be hampered by high temperatures and evaporation.
- 3. Quality and Species Issues:** Much like with Biodiesel, different species of algae have varying oil content, posing a significant challenge in achieving consistent oil yields.
- 4. Competition from Other Biomasses:** Algal biofuel faces competition from other forms of biomass for various applications, affecting its market acceptability. This competition, which includes sources like terrestrial crops and waste materials, influences the overall economic viability of algal biofuels. The challenge here lies in demonstrating the unique advantages and sustainability of algal biofuels in the face of these alternatives, as well as establishing a market presence that allows it to contribute significantly to the renewable energy portfolio.
- 5. Technical Hurdles:** Algal biofuel production involves a complicated, multi-step process, and the technology needs further development. This challenge is part of the broader effort to develop sustainable and cost-competitive renewable energy sources to reduce our reliance on fossil fuels, where progress in electricity generation is more advanced than in liquid fuels.
- 6. Land Use:** Scaling up algal biofuel production may require substantial land use, which needs to be balanced with other land-use priorities.[\[SB2\]](#) Balancing the cultivation of algae for biofuels with other land uses, such as agriculture or preserving natural ecosystems, becomes a complex task. Striking the right balance is essential to ensure that algal biofuel production does not lead to environmental or social trade-offs.

Conclusion

India's efforts to promote biodiesel production represent a commendable stride towards energy security and reducing its carbon footprint. In the long run, significant research on the development of second and third-generation feedstocks is required to meet India's growing bioenergy demands. To ensure its success, a combination of favorable government policies, community participation, and private-sector cooperation will be required.

To conclude, biodiesel production in India is about more than just alternative fuels; it is about transforming the future of energy in a rapidly evolving country. While challenges exist, India's commitment to

sustainability and innovation is set to transform the country's energy landscape.

FAQs:

What is the present scenario of biodiesel production in India?

Biodiesel production in India is evolving, with a focus on non-edible feedstocks and recycled cooking oil. While there is progress, low productivity, and economic barriers are among the challenges that need to be addressed.

How is India addressing the food vs. fuel dilemma in biodiesel production?

India deliberately avoids using edible feedstocks for bio-energy production, eliminating the food vs. fuel dilemma on a domestic scale.

What steps can the Indian government take to promote biodiesel production effectively?

The government can implement policies to incentivize biodiesel production, provide subsidies and incentives, and promote mandatory blending with conventional fuels at subsidized rates to popularize biofuels.

[1] <https://mopng.gov.in/en/refining/about-bio-fuel>.

[2] https://mopng.gov.in/files/uploads/NATIONAL_POLICY_ON_BIOFUELS-2018.pdf.

[SB1] We can look at replacing this with a link to the policies themselves, preferably accessed through government websites.

[SB2] Please elaborate.

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