

Biomass Briquettes: A Sustainable Solution to Control Rice Stubble Burning in India

Mohit Kumar, Dr. Gurshaminder Singh
UIAS ,Chandigarh University,Ghauran,Mohali, Punjab

Abstract- This paper reviews the role of biomass briquettes in addressing the pressing issue of rice stubble burning in India, particularly in states like Punjab, Haryana, and Uttar Pradesh. The practice of stubble burning, driven by economic and time constraints, contributes significantly to air pollution, soil degradation, and greenhouse gas emissions. Biomass briquetting presents a promising, environmentally friendly, and economically viable alternative for managing crop residues, converting agricultural waste into useful fuel. This paper explores the challenges of stubble burning, the benefits and process of biomass briquetting, and government initiatives aimed at promoting sustainable agricultural practices. The review concludes with recommendations to encourage the adoption of biomass briquettes, with implications for environmental sustainability, public health, and rural development

Keywords- stubble burning, Emissions, Impact, Particulates

I. INTRODUCTION

Rice is a staple crop in India, with major production concentrated in states like Punjab, Haryana, and Uttar Pradesh. However, the large-scale mechanized harvesting leaves behind significant amounts of stubble, leading farmers to burn the residue for rapid field clearance. This paper provides an in-depth review of biomass briquetting as an alternative to stubble burning, with a focus on its environmental, economic, and social implications in India.

II. RICE STUBBLE BURNING: CAUSES AND ENVIRONMENTAL IMPACT

The practice of stubble burning is driven by several factors:

Economic Pressure: The high cost of labor and limited availability of manual labor push farmers to burn stubble as the cheapest and fastest option.

Mechanized Harvesting: Mechanized harvesting leaves behind short stalks of rice stubble, which are difficult to collect and manage(1).

Crop Cycle Pressure: With a narrow window between rice harvest and wheat sowing, farmers rely on burning as a quick clearing method. The environmental impacts of stubble burning are severe:

Air Pollution: Stubble burning releases high levels of particulate matter (PM2.5, PM10) and greenhouse gases like CO₂, contributing to regional and global air pollution.

Public Health: The release of toxic pollutants causes respiratory issues, cardiovascular diseases, and other health complications.

Soil Health: Burning residues depletes soil nutrients, leading to long-term degradation of soil fertility and productivity(2).

III. BIOMASS BRIQUETTING AS A SOLUTION

Biomass briquettes offer a sustainable method to convert agricultural waste into compact, energy-dense fuel that can replace conventional fossil fuels.

The Biomass Briquetting Process: The process involves collecting rice stubble, drying it, shredding it into smaller particles, and compressing it under high pressure to form dense, cylindrical briquettes. The briquettes are then stored for use as fuel.

Environmental Benefits: Biomass briquettes reduce the need for stubble burning, leading to lower air pollution levels and a reduction in greenhouse gas emissions.

Economic and Social Benefits: The briquetting process creates jobs and provides farmers with an additional income source. Briquettes can be used in rural homes, providing an affordable alternative to firewood and reducing dependency on fossil fuels.

IV. TECHNOLOGICAL ADVANCEMENTS IN BIOMASS BRIQUETTING

Advancements in Briquetting Machinery: Modern briquetting machines are more efficient, compact, and mobile, allowing easier access for farmers. This mobility enables machines to operate closer to farmlands, reducing transportation costs.

Improved Quality of Briquettes: Recent innovations focus on increasing the density and energy content of briquettes, enhancing their suitability for both domestic and industrial applications.

Eco-friendly Production: Technological improvements now allow the briquetting process to use minimal water and energy, making it a more sustainable option.

V. GOVERNMENT INITIATIVES AND POLICY SUPPORT

India's government has launched several initiatives to promote alternatives to stubble burning, including biomass briquetting:

National Policy on Biofuels: The policy promotes the use of crop residues in biofuel production, incentivizing biomass-based fuel alternatives like briquettes.

Subsidies for Briquetting Equipment: Several states provide subsidies to make briquetting machines more affordable for farmers.

Awareness Campaigns: Campaigns aim to educate farmers about alternatives to stubble burning, including demonstrations on briquette-making.

Despite these efforts, challenges in policy implementation exist:

Limited Access to Funding: Small farmers often struggle to access subsidies and financing for briquetting equipment(2).

Awareness Gaps: Many farmers lack knowledge about the environmental and economic benefits of briquetting, limiting adoption rates.

VI. CHALLENGES IN IMPLEMENTING BIOMASS BRIQUETTING

Adoption of biomass briquetting in India faces several challenges:

High Initial Costs: The equipment and operational costs of briquetting machines are high, especially for small-scale farmers.

Transportation and Logistics: Transporting stubble to briquetting centers is costly and complex, particularly in rural areas with limited infrastructure(3).

Market Development: The briquette market remains underdeveloped, with limited demand and fluctuating prices. Large-scale industries have not widely adopted briquettes as an alternative fuel.

Technical Barriers: Biomass briquettes require specific moisture levels for efficient production, which can be challenging to maintain. Additionally, quality control and standardization remain issues.

Case Studies of Successful Biomass Briquetting Initiatives

Punjab's Biomass Power Plant: This project involves collecting rice straw and converting it into briquettes used to power a biomass plant, significantly reducing stubble burning in the region(4).

Farmer Cooperatives in Haryana: Farmer cooperatives in Haryana have successfully implemented briquetting practices by sharing the costs of briquetting machinery. These cooperatives demonstrate how collective efforts can reduce individual financial burdens and promote sustainable practices.

Comparative Analysis: Successful case studies highlight the importance of community involvement, government support, and public-private partnerships in promoting briquetting practices(5).

Recommendations for Scaling Biomass Briquetting in India

To encourage the adoption of biomass briquetting, the following recommendations are proposed:

Increased Subsidies and Financial Incentives: To offset high costs, the government could provide larger subsidies for briquetting equipment and operational expenses.

Expansion of Briquette Markets: The government can promote the use of briquettes in industries like cement, steel, and power plants, creating stable demand.

Enhanced Farmer Training Programs: Training programs can help farmers understand the benefits and practicalities of briquetting, ensuring proper implementation.

Public-Private Partnerships: Collaboration with private companies could lead to the development of briquetting infrastructure, marketing support, and rural employment.

VII. CONCLUSION

Biomass briquetting presents a practical solution to the environmental, health, and economic challenges posed by rice stubble burning in India. By converting agricultural waste into valuable fuel, briquetting can improve air quality, reduce greenhouse gas emissions, and create economic opportunities for rural communities. The adoption of biomass briquettes as an alternative to stubble burning requires collaborative efforts from government agencies, private enterprises, and farmers. With targeted policies, increased funding, and widespread awareness, biomass briquetting has the potential to play a significant role in India's sustainable agricultural future.

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