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Co-Pelletization Technology to Enhance the Characteristics of Fuel Pellets

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Background

The potential for biomass varies greatly around the world, depending on factors such as climate, land availability, and feedstock availability. However, there is a significant amount of biomass available globally that could be used to produce renewable energy. According to estimates by the International Energy Agency (IEA), the technical potential for biomass-based energy production worldwide is around 100 exajoules (EJ) per year. This includes all type of biomass including energy crops, agricultural residues, forestry residues, and municipal solid waste.

India has significant biomass potential due to its vast agricultural and forestry resources. According to estimates by the Ministry of New and Renewable Energy (MNRE), India's annual biomass availability is approximately 500 million metric tons, which includes agricultural residues, forest residues, and urban waste. In terms of feedstock availability, agricultural residues such as rice straw, wheat straw, and biogases are the primary sources of biomass in India. These residues are generated in large quantities every year and are typically burned or left to rot in the fields, causing air pollution and greenhouse gas emissions. However, they can be used as feedstock for bio energy production instead. India’s potential for biomass-based energy production is significant. According to the MNRE, the estimated potential for power generation from biomass in India is around 18 GW, which could meet approximately 9% of the country's total electricity demand. In addition to power generation, biomass can also be used for heating, cooking, and transportation. The Indian government has launched several initiatives to promote the use of biomass for energy production, including subsidies and incentives for the development of biomass power plants, as well as programs to promote the use of improved cook stoves and biogas plants in rural areas. However, the use

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of biomass in India is still limited by various factors, including the lack of infrastructure and financing, as well as the low efficiency of traditional biomass conversion technologies.

Co-pelletization process

India is one of the largest agricultural producers in the world, and as a result, the country produces a significant amount of crop residue every year. According to the Ministry of Agriculture and Farmers' Welfare, the estimated production of crop residue in India in 2020-21 was around 620 million metric tons. This includes approximately 240 million metric tons of rice straw, 160 million metric tons of wheat straw, and 120 million metric tons of sugarcane bagasse. This large crop production generates massive amount of biomass. Pellet from these low value waste products can be an alternative source of national and global economy. The Co-pelletization is the process of combining two or more different types of materials into a single pellet. In the context of fuel production, co-pelletization is used to produce fuel pellets that contain a combination of biomass and coal, or biomass and other materials.

Torrification is a thermo chemical process that involves the partial carbonization of biomass at a temperature range of 200-300°C in an oxygen-limited environment. This process produces a solid bio fuel that has several advantages over raw biomass, including increased energy density, improved storage and handling characteristics, and reduced moisture content.Torrified biomass can be further processed into pellets, which are a convenient and efficient form of bio fuel for energy production. Pellets made from torrefied biomass have several advantages over pellets made from raw biomass, including higher energy density, lower moisture content, and improved grind ability and durability. The process of producing pellets from torrified biomass involves several steps. First, the torrified biomass is ground into a fine powder using a hammer mill or other grinding equipment. The powder is then mixed with a binder, typically a natural polymer such as lignin, and fed into a pellet mill. The pellet mill compresses the mixture under high pressure and temperature, forcing it through a die to produce pellets of a uniform size and shape. The process flow chart for the production of pellets as shown in Fig. 1. The resulting pellets can be used for a variety of applications, including heating, power generation, and transportation. They have a high energy density, which makes them easy to transport and store, and they can be burned in a variety of combustion systems, including stoves, boilers, and furnaces. The production of pellets from

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torrified biomass has several advantages over other forms of bio energy production. It can increase the energy density and efficiency of the fuel, reduce transportation costs and emissions, and improve the sustainability of biomass utilization by reducing waste and improving the economics of biomass conversion. However, the production of torrefied pellets requires significant investment in equipment and infrastructure, and the market for this type of biofuel is still developing.

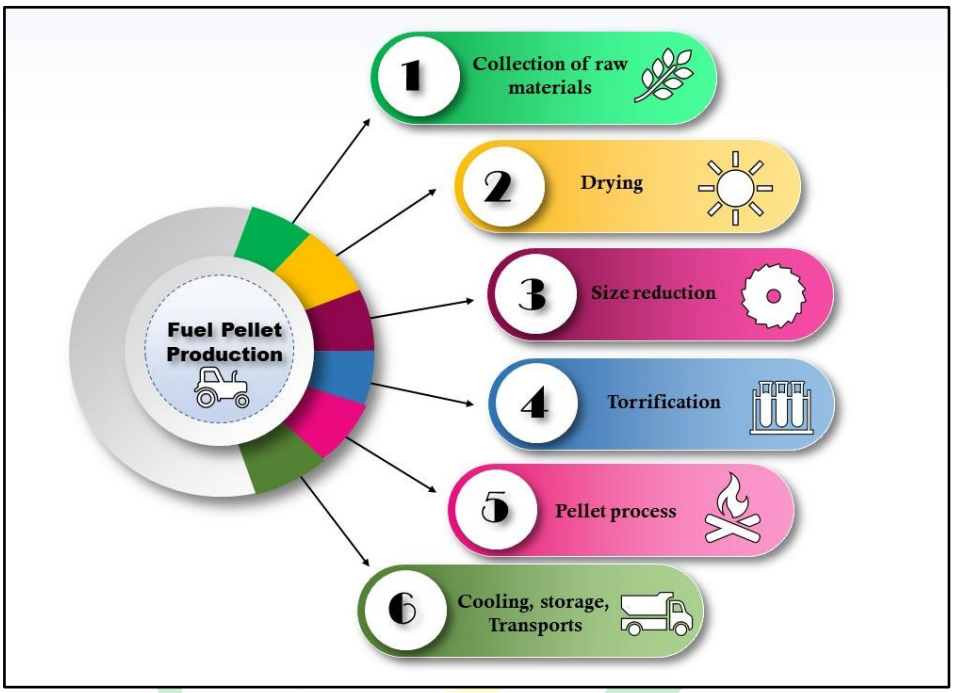

Fig. 1 Pelletization process for conversion of biomass into fuel pellets

Application of torrefied fuel pellets

Co-pelletization can be used to produce a more uniform and consistent fuel that has improved combustion characteristics and higher energy density than individual feedstocks. There are several applications for co-pelletization, including:

- **Power generation:** Co-pelletization can be used to produce pellets that are suitable for use in power generation systems, including steam turbines and combined heat and power (CHP) systems. Co-pelletization can also help to reduce the cost of fuel by using lower-cost feedstocks in combination with higher-cost feedstock.
- **Heating:** Co-pelletization can be used to produce pellets that are suitable for use in residential and commercial heating systems, including pellet stoves and boilers. The

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high energy density of co-pellets means that they can provide long-lasting heat with minimal ash and emissions.

- **Transportation:** Co-pellets can also be used as a transportation fuel, either in their pure form or in combination with other fuels such as diesel. The high energy density of co-pellets makes them ideal for use in long-distance transportation applications, including trains and ships.
- **Industrial processes:** Co-pellets can also be used as a feedstock for industrial processes, including cement production and steelmaking. The consistent and uniform nature of co-pellets can help to improve the efficiency and consistency of these processes.
- Overall, co-pelletization can provide a range of benefits, including improved fuel properties, reduced emissions, and increased efficiency in energy and industrial processes. The application of co-pellets is expanding rapidly as technology advances and more feedstocks become available for use in this process.

Job opportunities

The co-pelletization process involves mixing two or more types of feedstocks to create a new product that has improved properties and characteristics. This technique is commonly used in the production of iron ore pellets, where various types of iron ore are mixed with binders and additives to form a cohesive product that can be easily transported and processed in blast furnaces. Also, it creates job opportunities in various ways:

- **Production jobs:** The co-pelletization process requires skilled and unskilled workers to operate and maintain the equipment involved in the process, including mixers, pelletizers, and dryers. This can create jobs for technicians, machine operators, and maintenance workers.
- **Research and development jobs:** The co-pelletization process is constantly evolving, and new techniques and technologies are being developed to improve the efficiency and quality of the pellets produced. This creates opportunities for scientists, engineers, and researchers to work on developing new processes, materials, and equipment.
- **Transportation and logistics jobs:** Co-pelletization can also create jobs in transportation and logistics, as the finished pellets need to be transported to customers

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or processing facilities. This can create job opportunities for truck drivers, logistics coordinators, and warehouse workers.

- **Marketing and sales jobs:** As the demand for co-pelletized products increases, companies may need to expand their sales and marketing teams to promote and sell their products. This can create jobs for sales representatives, marketing managers, and customer service representatives.

Overall, the co-pelletization process can create a range of job opportunities across different industries, from manufacturing and production to transportation and logistics, research and development, and marketing and sales.

Conclusion

In conclusion, Co-pelletization technology has shown promise in enhancing the characteristics of fuel pellets. By combining different biomass materials, such as agricultural residues and wood wastes, co-pelletization can produce pellets with improved energy density, calorific value, and durability. Additionally, the technology can effectively reduce the ash content and emissions from burning biomass fuels. The application of this technology can also help to overcome the challenges associated with the heterogeneity of biomass feedstocks, as well as the high cost and low availability of certain biomass resources. Overall, co-pelletization technology can be a valuable tool for producing high-quality biomass pellets that can contribute to a more sustainable and renewable energy future.

Reference

Sarker, T.R., Azargohar, R., Dalai, A.K. and Meda, V., 2021. Characteristics of torrefied fuel pellets obtained from co-pelletization of agriculture residues with pyrolysis oil. *Biomass and Bioenergy,* 150: 1-13