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Assessing the Environmental Sustainability of Jute Bags in India



Acknowledgement

It's our pleasure to present the report 'Assessing the Environmental Sustainability of Jute Bags in India' which critically assesses the environmental sustainability of jute bags as compared to union bags in India. The Energy and Resources Institute (TERI) is extremely grateful to the Indian Jute Mills Association (IJMA) and their Chairman Mr Raghavendra Gupta for their incredible support throughout this project. The guidance and support that the team provided helped us in the development of a comprehensive research output.

Authors:

- » Souvik Bhattacharjya, Senior Fellow and Associate Director, TERI
- » Kartikey Sharma, Research Associate, TERI
- » Mandavi Singh, Research Associate, TERI
- » Trinayana Kaushik, Research Associate, TERI
- » Khushi Gupta, Project Associate, TERI

TERI Publications Team:

- » Abhas Mukherjee, Editor, TERI
- » Sudeep Pawar, Graphic Designer, TERI

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The Energy and Resources Institute, New Delhi, India For more information Project Monitoring Cell The Energy and Resources Institute, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi 110 003, India | Tel.: +91 11 2468 2100 or 2468 2111 | Fax: +91 11 2468 2144 or 2468 2145 Email: pmc@teri.res.in | Web: www.teriin.org

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1. Introduction

India plays important role in global climate change policy formulation. The decisions made by India in the coming years will have a significant impact on the sustainable future of the world and the preservation of environmental ecosystems. Recognizing the need to address the growth of unsustainable lifestyles among its population, India's Prime Minister, Shri Narendra Modi, launched the Lifestyle for the Environment (LiFE) movement during the 2021 United Nations Climate Change Conference (COP26) in Glasgow.

The LiFE Movement aims to promote an environmentally conscious lifestyle that emphasizes "mindful and deliberate utilization" rather than "mindless and wasteful consumption." This approach encourages individuals to consider the environmental impact of their actions and make conscious choices that contribute to sustainability. By embracing this mindset, people are encouraged to avoid excessive consumption and wastage, thereby reducing their ecological footprint.

Transitioning to alternative sustainable materials can help mitigate the carbon intensity associated with plastic production and its impact on climate change. In this regard, the use of jute for packaging plays an important role from sustainability perspective due to its renewable nature, biodegradability, and low carbon footprint, positive impact on soil health, reduced water consumption, versatility, and economic significance. By choosing jute products over synthetic alternatives, individuals and industries can contribute to a more sustainable and environmentally friendly future. In recent years, globally there has been a renewed interest in jute as a sustainable and eco-friendly alternative to synthetic materials. It is being used in various industries, including textiles, packaging, construction, and even in the automotive sector. The versatility and environmental benefits of jute makes it a valuable natural resource with the potential to contribute to a greener and more sustainable future.

Given the need and importance of jute within environmental context; this report aims to understand the environmental sustainability and economic viability of Union bags.

2. Jute and Its Importance in Indian Context

Historically, jute has been an integral part of the textile industry, primarily used for making sacks, bags, and ropes due to its high tensile strength and durability. Its fibrous nature also makes it suitable for manufacturing carpets, mats, and other home furnishings. Jute has a golden-brown colour and a soft texture, giving it a distinct appearance.

Widely known for its eco-friendliness and sustainable nature, the product is 100 % biodegradable and renewable in nature, whose cultivation helps in reducing carbon dioxide levels in the atmosphere. According to FAO¹, one hectare of jute plantation can absorb up to 15 tons of carbon dioxide and in return releases 11 tons of oxygen during a season which is about 100 days. This is a boon for the already polluted environment. Jute plants also have a positive impact on soil fertility as they are nitrogen-rich and have a deep-rooted system that prevents soil erosion. Unlike plastics, jute also does not generate toxic gases when burnt.

Jute has played a significant role in the Indian economy for several decades:

Employment Generation: The 150 years old, jute industry is one of the prominent industries in India. From jute cultivation and harvesting to processing, manufacturing, and exporting, the industry creates jobs at various stages of the value chain. It provides direct employment to 3.70 lakh workers in the country and supports the livelihood of around 40 lakh farm families.² It supports the livelihoods of farmers, factory workers, artisans, traders, and other associated personnel.

Foreign Exchange Earnings: Jute and jute products contribute to India's export earnings, thereby boosting the country's foreign exchange reserves. India has been one of the largest exporters of jute and jute goods in the world. Exports of raw jute were valued at Rs. 449.40 crores (US\$ 58 million) in the year 2021-22.³ Furthermore, jute products such as sacks, bags, carpets, mats, and handicrafts are in demand globally due to their eco-friendly and sustainable nature.

Industrial Output: The jute industry contributes significantly to India's industrial output. Jute mills spread across various jute-producing states, process raw jute fibres into various end products. These mills involve a range of activities, including spinning, weaving, dyeing, printing, and finishing. The industry contributes to the overall manufacturing sector and supports related industries such as packaging, textiles, and handicrafts.

¹ <https://www.fao.org/economic/futurefibres/fibres/jute/en/>

² <https://pib.gov.in/PressReleaselframePage.aspx?PRID=1901434>

³ <https://www.ibef.org/exports/jute-industry-india>

Rural Development: Jute cultivation and jute-based industries have a positive impact on rural development. Jute is primarily grown in rural areas, providing income opportunities to farmers. The cultivation of jute helps in improving the socioeconomic conditions of farmers, particularly in regions where alternative cash crops may not be viable. It also encourages rural entrepreneurship and the development of small-scale industries.

Environmentally Sustainable Industry: Jute is often referred to as the “Golden Fibre” due to its Colour and environmentally friendly properties. The jute industry contributes to sustainable development by offering eco-friendly alternatives to synthetic materials. Jute products are biodegradable, renewable, and have a low carbon footprint. The cultivation of jute plants also helps in soil conservation, preventing erosion and enhancing soil fertility

Government Revenue: The jute industry contributes to government revenue through various channels. Taxes, duties, and levies imposed on jute cultivation, processing, and trade generate revenue for the government. Additionally, the industry’s growth and profitability contribute indirectly to increased tax collections through income tax, corporate tax, and other related taxes.

Overall, the jute industry has been a vital sector in the Indian economy, providing employment, foreign exchange earnings, industrial output, and sustainable development. It has contributed to the socioeconomic development of rural areas and helped position India as a global player in the jute market.

3. Problems associated with Union bags

3.1 Environmental Impact

The seemingly convenient, cheap and readily available transportation solution for purchased goods, polymers have infiltrated into our daily lives. But plastics have a tremendous and growing environmental cost that we are beginning to recognize. Their use is increasing so much that they are outpacing our ability to deal with them. Almost all plastics (99 %) are made from fossil fuels. Polypropylene fibres are manufactured from the polymerization of propylene, which is derived from petroleum. PP has an unusually large number of industrial and consumer uses due to its low cost, ease of processing, stiffness, strength, and transparency. Long term usage and exposure of PP and its products to high temperature can lead to leaching of toxic chemical constituents. The challenge of waste from polymers is a global one, especially in countries with continuously evolving waste recycling systems.

The weight of a 100% jute bags is 580 grams, while the Jute/PP union bags weigh a total of 360 grams. Although the reduced weight may signal an augmented level of environmental efficiency as compared to the incumbent product, it is not the correct measurement of sustainability. While polypropylene is a lightweight material which decreases the overall weight of the bag, the total life cycle emissions of polypropylene is higher than equivalent amount generated by a jute bag because the former is a petroleum derived material while the latter is bio derived. The union bags have a total of 270 g of jute and 90 g of polypropylene which have life cycle GHG emission of 1.9 kg CO₂ eq. per bag while the 100% jute bag made of 580 g of jute yarn, has a life cycle GHG emission of 1.6 kg CO₂ eq. per bag. We see that there is a 19% increase in GHG emissions generated per union bag, as compared to the 100% jute bag. This analysis has been conducted through life cycle assessment (ISO 14040 series) using Sima Pro (version 9.3.0.3).

» Non-biodegradability of Polypropylene

The proposer old Union bags claims that the union bags are environmentally friendly, but the argument remains flawed because there is no clarity on the eco-friendly components that make up the bag. Tokiwa Y et al. (2009)⁴, in their paper have conclusively revealed that polypropylene is carbon intensive in nature due to its reliance on fossil fuels throughout its lifecycle, from raw material extraction to production, use, and end-of-life management. Also, even though plastic can be reused, it is not biodegradable. The production of plastic requires the extraction and

⁴ Yutaka Tokiwa, Buenaventurada P. Calabia, Charles U. Ugwu, and Seiichi Aiba, "Biodegradability of Plastics". Int J Mol Sci. 2009 Sep; 10(9): 3722-3742. Refer: Biodegradability of Plastics - PMC (nih.gov)

processing of fossil fuels, primarily petroleum (crude oil) and natural gas. These fossil fuels are carbon-rich resources, and their extraction and refining processes involve energy-intensive operations that release significant amounts of carbon dioxide (CO₂) and other greenhouse gases into the atmosphere. After extraction, they undergo a series of chemical processes to produce the polymers used in plastic production, such as polyethylene, polypropylene, and polystyrene. These processes often involve high temperatures, pressures, and the use of catalysts, resulting in substantial energy consumption and greenhouse gas emissions. There is no doubt that recycling can help mitigate the carbon impact of plastic, however, it has its own challenges. The recycling process itself requires energy and often involves complex sorting and processing methods. Additionally, not all types of plastic are easily recyclable, and the recycling rates for plastic are relatively low worldwide. As a result, a significant amount of plastic ends up in landfills or as litter contributing to global carbon emissions.

Despite all the apprehensions about plastic; a contradictory argument is posed by the proposer of the union bag that 25% polypropylene will make bags more sustainable. Careful assessment is hence required to establish the reduction in carbon footprint through the use of union bags.

» Issues with material segregation process

As informed by the proposer of the union bag, the process of segregation of two primary materials i.e., jute and polypropylene are manual, which seems extremely unfeasible considering the quantity of bags that will be used. The collection process of the union bags has also not been defined; as the bags will be distributed in all parts of the Country vide the Public Distribution System of food grains. Though the up cycling method of shredding the used bags and turning them into value added products tackles the existing problem to a negligible extent only. Additionally, since the state of the bag will continue to degrade during its life, the plastic infused in the jute bag will slowly begin tatter, and turn into micro plastics which can leach into the system. This cannot be prevented by any existing technology.

In India, plastic recycling rate is 60%. The remaining 40% of this plastic waste ends up being uncollected / littered which eventually causes choking of drains and land & water pollution (CSE 2019a)⁵. The 6% of this uncollected/littered plastic waste comprises other types of plastics which on top of being multi-layered are also non-recyclable in nature (CSE 2019b)⁶. According to the memorandum issued MoEFCC, dated 21st March 2023; 'Smart bags' (Union bags) fall under the category of multi-layered plastic (MLP) packaging. In general, the MLP's are one of the most least recycled product as it is a very labour-intensive process across all stages of the value chain such as collection, cleaning etc. Plastics such as Polypropylene (PP), Polystyrene (PS), and Low density polyethylene (LDPE) are partially recyclable but generally not recycled in India due to the economic

⁵ Centre for Science and Environment (CSE) (2019a). The plastics factsheet https://cdn.cseindia.org/attachments/0.57139300_1570431848_Factsheet1.pdf

⁶ Centre for Science and Environment (CSE) (2019) The plastics factsheet https://cdn.cseindia.org/attachments/0.97245800_1570432310_factsheet3.pdf

unviability of their recycling process (CSE 2020)⁷. Even in countries like the USA, where the plastic recycling infrastructure and technology is well developed, only about 1% of all polypropylenes is actually recycled⁸. Whereas jute is a 100 % recyclable natural material. Weaving it up with PP into a product where it becomes extremely difficult to get pure jute back, the chemical properties of PP might influence that of jute's, only indicates that the recycling potential the woven jute is also eliminated.

3.2 Health and Safety Concerns

» Chemical Additives and Contaminants

The major chemical component present in PP products is phthalates, which are used as plasticizers to make the material softer and more resilient. This chemical is not considered toxic or carcinogenic. However, phthalates are known to produce reproductive abnormalities, including the feminization of males and underdeveloped male genitalia in animals by disrupting foetal development. So, it's best to use cautionary measures when handling any PP plastics. Other than these chemicals, polypropylene contains resins, catalysts, solvents, antioxidants, and ultraviolet stabilizers.

Furthermore, PP has a high thermal expansion coefficient which limits its high temperature applications. It is also susceptible to UV degradation, has a high flammability and susceptible to oxidation. Keeping in mind the harsh Indian temperatures, PP fibre could be harmful as several toxins might release due to high temperatures. Polypropylene is a synthetic fibre and it does have some health implications considering the chemical. In 2020 researchers reported that polypropylene infant feeding bottles with contemporary preparation procedures were found to cause micro plastics exposure to infants ranging from 14,600 to 4,550,000 particles per capita per day in 48 regions. Micro plastics release is higher with warmer liquids and similar with other polypropylene products such as lunchboxes.⁹ Longer storage is not tested, and the inclusion of these Union bags is being proposed without the backup of any scientific studies on their impact on the grains. BIS themselves have mentioned clearly that they have not taken any study regarding effect of storage of grains in these bags.

⁸ "Polypropylene Recycling - An Introduction". The Balance Small Business. Retrieved 2021-11-01.

⁹

- Carrington, Damian (19 October 2020). "Bottle-fed babies swallow millions of microplastics a day, study finds". The Guardian. Retrieved 9 November 2020.
- "High levels of microplastics released from infant feeding bottles during formula prep". phys.org. Retrieved 9 November 2020.
- Li, Dunzhu; Shi, Yunhong; Yang, Luming; Xiao, Liwen; Kehoe, Daniel K.; Gun'ko, Yurii K.; Boland, John J.; Wang, Jing Jing (November 2020). "Microplastic release from the degradation of polypropylene feeding bottles during infant formula preparation". *Nature Food*. 1 (11): 746–754. doi:10.1038/s43016-020-00171-y. hdl:2262/94127. ISSN 2662-1355. S2CID 228978799. Retrieved 9 November 2020.

3.3 Economic and Regulatory Concerns

» Import Dependency

The origin of the Union bags hasn't been revealed. Although the manufacturer has revealed that the bag is produced from high quality Tossa Jute of grade TD 1/TD2, this can't be corroborated as production of high-quality Jute is very limited. The Ministry of Textiles, reports that hardly any TD1 & TD2 are grown in India. Hence, it can be concluded that the high-quality Jute, used for manufacturing the bag has been imported from neighbouring nations like Bangladesh. The industry imports 4-5 lakhs bale of high-grade jute from Bangladesh every year for meeting their requirements. In such a case the production of the bag violates the Jute Packaging Materials (JPM) Act of 1987 which states that the jute used to make jute sacks must be sourced from India. Hence, a deeper assessment is needed.

» Lack of technical infrastructure

The lack of infrastructure can have significant economic implications for a country or region. Without adequate infrastructure, economic activities can be constrained or disrupted and it puts businesses at a competitive disadvantage compared to regions with better infrastructure. Insufficient transportation networks, for example, can hinder the movement of goods and people, leading to increased costs, reduced productivity, and limited market access. Investors, both domestic and foreign, consider the quality and availability of infrastructure when deciding where to invest. Insufficient infrastructure can deter potential investors, as it increases operational costs, lowers productivity, and adds uncertainty to business operations.

Considering the fact that jute mills do not have the infrastructure to manufacture cloth which could facilitate the making of the proposed Union bags. Being cost intensive, developing infrastructure from an economic standpoint remains an unviable option. Also, the fabric used in manufacturing union bags shall be woven as tube on circular loom. However, there is no jute mill that has such type of circular looms to manufacture tabular fabric.

Further, the jute bag manufacturers currently don't have the machinery to manufacture the union bag proposed by the committee. Its installation will require overhauling the manufacturing units currently in place across all jute manufacturing units in the country, which from a financial standpoint is extremely unviable proposition for the milling industry

» Ambiguity within the value chain

The proposer of this union bag has stated that the yarn which is used to manufacture its 'Union Bags' has been acquired from Mohan Jute, based out of Kolkata. However, the said company doesn't have the capacity or the infrastructure to make this yarn. This ambiguity within the value chain process has not been addressed, and needs to be looked at closely from a legal standpoint.

» Regulatory concern

According to the standards that govern the usage of jute bags for food grain packaging, state that any bag used for this purpose should be of correct food grade quality. However, as of now it has not been reported if the union bags meet this standard. Also, no protocols for reuse, recycling and

disposal of union bags have been defined by the competent regulatory authorities. Furthermore, no BIS standards have been issued for the union bags with respect to food storage. This list considerable lack of regulatory actions with respect to the usage of union bags is a threat for the Indian food security system, and can potentially disrupt the entire system if their usage is sanctioned without critically looking at the gambit of its impact across all actors within the value chain and beyond.

4. Conclusion and Future Outlook

The importance of jute bags in food grain packaging instead of union packaging is significant from multiple perspectives as already established, including environmental sustainability, economic benefits, and food safety. From an environmental standpoint, jute bags offer a more sustainable alternative to plastic packaging. It is a renewable and biodegradable fibre, whereas plastic is derived from fossil fuels and can persist in the environment for hundreds of years. By choosing jute bags, we can reduce the plastic waste and minimize the negative impacts of plastic pollution across the natural ecology.

Moreover, jute cultivation contributes to carbon sequestration and soil health, making it an environmentally friendly choice. Jute plants have deep root systems that prevent soil erosion and add organic matter to the soil, reducing the need for chemical fertilizers and promoting sustainable agricultural practices. Economically, jute bags support livelihoods, particularly in developing countries where jute cultivation and manufacturing are prevalent. By promoting the use of jute bags, we contribute to sustainable economic opportunities and the well-being of communities involved in jute production.

Further, one of the reasons stated behind the inclusion of union bag as a potential alternative to jute bags is to manage supply side gaps if they ever occur. However, the issue of demand supply gap, has already been addressed by the jute industry which is now geared to supply in excess of 45 lakh bales annually for food grain packaging. Moreover, if there is a need to have a secondary packaging option there are other products in the market that can act as a secondary option. There is no need to insert a packaging material which doesn't have recycling capability, isn't biodegradable in nature, and is a financial burden on the jute mill.

Moreover, when it comes to food safety, jute bags provide a breathable and natural packaging solution. They allow airflow, reducing the risk of moisture build-up and the growth of mold and bacteria. Jute bags are also free from harmful chemicals commonly found in plastic packaging, ensuring the integrity and safety of food grains. Overall, the use of jute bags in food grain packaging offers a holistic approach to sustainability by addressing environmental concerns, supporting local economies, and ensuring food safety.



