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RESEARCH ARTICLE

Jute and kenaf carrier bags: an eco-friendly alternative to plastic bags in India

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Abstract

Increasing demand for shopping and packaging carrier bags has given rise to various issues relating to its disposal as well as to the overall environmental footprint and sustainability of the packaging materials. This study assesses the carbon footprint and life cycle environmental impacts of the production, usage, and disposal of low density polyethylene (LDPE) and two natural fibre carrier bags (jute and kenaf). Life cycle assessment study was conducted of all inputs and outputs, aggregated in the form of resources used and environmental emissions, extending from the production of raw materials to the final disposal of the product. The carbon footprint and GHG emissions of jute and kenaf carrier bags were estimated using the CO_2, N_2O, and CH_4 emissions coefficients of inputs. Research literature from life cycle impact assessment (LCIA) results was used to determine the effects of LDPE polyethylene packaging material. It was observed that the global warming potential (GWP) for the production of 1 kg of LDPE (100 micron) carrier bag (39.4 kg CO_2eq) is more than 490 times higher than jute and kenaf carrier bags. In general, LDPE materials have the greatest impact on the carbon footprint and resource depletion. The LDPE material also has the highest impacts on indicators of terrestrial ecotoxicity, photochemical oxidation, acidification, and eutrophication as compared to jute and kenaf fibres. Since jute and kenaf are natural fibres, they sequester a substantial quantity of carbon during their agricultural stages. As a result, greenhouse gas (GHG) emission emissions of jute and kenaf were found to be negative. Popularising the use of jute and kenaf products as alternatives to plastic in industrialised countries would benefit the reduction of plastic waste and its negative environmental effects. Additional production of jute and kenaf fibre, which are already available in major bast fibre producing countries like India and Bangladesh, could meet the demand for fibre-based carrier bags.

Keywords Single-use bags · Re-usable bags · Jute and kenaf bag LCA · LDPE plastic · Carbon footprint · Environmental indicators

Introduction

Scientists estimate that 11 million metric tonnes of plastic waste enter the ocean each year (Mallos 2022). Plastic waste was relatively easy to handle during the 1950s and 1990s because only 100 million metric tonnes of plastic were produced during that time. The generation of plastic waste, however, tripled over the past 30 years (350 million tonne) between the 1990s and the 2020s, indicating a parallel increase in plastic manufacture (OECD 2022). In the first decade of the twenty-first century, more plastic waste was produced than in the previous 40 years combined (Karasik et al., 2020; Worm et al. 2017; Geyer et al. 2017; PlasticsEurope 2018). Currently, the UN Environment Programme (UNEP) estimates that over 300 million tonnes of plastic garbage are created annually. Additionally, about 98% of

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