

Utilization of Agricultural Wastes for Alternative Material to Plastics in Kenya and the East African Community

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Introduction: Marine plastic litter is a serious issue in the world. One of the effective ways to reduce litter is to develop plastic alternative materials as substitutes. In previous works, alternative production from agricultural wastes has been examined comprehensively in Egypt. Meanwhile, East African countries are also facing the marine plastic litter issue. This research aims to tackle the issue of plastic pollution and promote sustainable development by exploring the potential of utilizing agricultural wastes as an alternative to plastics in Kenya and the wider East African Community (EAC). We conducted a comprehensive investigation aiming to find sustainable materials made from agricultural by-products that can replace petroleum-based plastics in various sectors throughout the region.

Methods: The viability of utilizing agricultural waste as a substitute for plastics in Kenya and EAC was investigated by focusing on six major crops: maize, sugarcane, cassava, wheat, rice, and banana. The selection criterias were agro-waste production, replacement ratio, manufacturing feasibility, logistics of collecting agro-waste, and environmental impact. The potential amount of plastic that could be replaced by each crop was estimated. The environmental impacts of the petroleum-based plastic and agro-waste based alternative products were also assessed. The littering potential of both products was also considered.

Results: Maize was found to be the best alternative crop. Approximately 156,000 tons of maize stalk can be collected from five regions of Kenya, which can produce around 62,000 tons of paper. This would replace 9,000 tons of plastic bags. The environmental assessment of the global warming potential showed that stalk to paper production has approximately 1400% less CO₂ equivalent emission compared to open burning of the maize stalk, even though paper production has 8.2 times more CO₂ equivalent emission than the plastic bag production.

Discussion: Despite its promising potential, the production of the paper bag itself is significantly higher in terms of the global warming potential. On the other hand, behind the drawback of the paper bag production itself, the utilization of unutilized maize residues into paper bags instead of being burned in the open field could reduce or even eliminate the current burning problem on the field, which contributes to the CO₂ emissions itself. The current state of industry globally, in terms of maize-based paper, is also still relatively premature and ineffective, hence the number of existing systems is still considerably low. As the proposed system has an abundance of currently unutilized raw materials and high demand of resulting products, there is a future potential of optimizing the system to make it viable, effective, and producing lower global warming potential.

Conclusion: Maize stalk as an agro waste from the maize plantation deemed to be most suitable raw materials for the production of alternative products towards the existing situation and problem in Kenya and East African Community. The assessment towards the utilization of maize stalks shows its promising potential.

Keywords: Marine plastic litter; Alternative material; Agricultural waste; Kenya; East Africa

Related SDG Goals: SDG 12 (Responsible Consumption and Production), SDG 9 (Industry, Innovation, and Infrastructure), SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 17 (Partnerships for the Goals)