Exploring the Alternatives for Pharma Packaging Materials – Wealth from Waste Concept to Control Climate Changes

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Abstract. Plastic container pollution has escalated to a global catastrophe, contributing to climate change and global warming. During their entire life cycle, plastics contribute 3.4% of greenhouse gas emissions worldwide and have a large carbon footprint. Every stage of the burning process produces toxic emissions and contaminants into the surrounding air. If created plastic garbage is not properly handled and managed, it can have numerous negative effects on the environment after usage Fossil fuel-derived compounds are used to make plastics. These chemicals provide short- and long-term health risks, ranging from respiratory ailments to negative neurological impacts such as anxiety and panic attacks. The purpose of this review is to go over the lifecycle of several plastic goods, including as high-density polyethylene (HDPE), polypropylene (PP), and polyvinyl chloride (PVC-U), that are utilized in pharmacy packaging. The idea of wealth from waste is one such strategy for reducing the effects of plastic pollution on the climate. Burning waste materials like sugar bagasse and wheat straw grass releases dangerous and toxic gases into the atmosphere. These materials can be used as replacements to plastic bags and containers, respectively, reducing air pollution and thereby regulating climate change related health perspectives.

Keywords: Sugarcane Bagasse, wheat straw plastic, global warming, climate changes.

1 Introduction

One of the major contributors to pollution and climate change are plastic containers and bags. Humans, as well as marine and terrestrial animals, are becoming more and more endangered due to the Phenomenon's effects on the ecosystems. To try and control the expanding waste problem, the government had started implementing certain policy measures. The fact that it contaminates the environment has drawn the attention of governments, environmental advocacy groups, and non-governmental organizations from all over the world. This has increased pressure on retail pharmacy

ICSETPSD 2023, November 17-18, Coimbatore, India

DOI 10.4108/eai.17-11-2023.2342848

locations to dissuade patrons from using plastic bags. The purchase of plastic bags at payment tills has turned into a routine habit among retail customers. Several other strategies are being considered in various countries to reduce the use of single-use plastic bags and containers, in addition to economic tools like taxes, subsidies, and deposit-refund systems. To encourage pro-environmental behavior, alternative policy responses include command and control tactics are the need of the hour. This paper aims to identify alternatives for plastic containers in pharma packing and to reduce the unwanted burning of sugarcane bagasses and wheat grass straw extract to overcome the climate change related health perspectives .

2 Discussion

AThe pharmaceutical industry produces over 300 million tons of plastic waste annually, half of which is single-use. This information is reported by the World Health Organization. Considering that medical containers and pharmaceutical packaging account for 85% of the waste produced by healthcare-related organizations, bioplastics may be able to replace these potentially hazardous materials with more reusable and environmentally friendly alternatives. Wheat straw containers can be used in place of the containers, and sugarcane bagasse bags can be used in place of the plastic bags.

2.1 WHEAT STRAW

Fig. 1. Wheat is ready for harvest.

The plastic can be made out of wheat straw shown in the figure 1. In order to make plastic out of it the cellulose lignin needs to be broken down by the bacterium Rhodococcus jostii (found in soil). Making various types of polymers is made possible by this process.Made from wheat straw, polymers are entirely natural.

A pulp is formed out of the lignin. After that, the pulp is formed into containers (such as screw bottles, pump bottles, etc.)

One important agricultural waste and raw material is wheat straw. An estimated 540 million tons of wheat straw were expected to be produced annually. Both straw and wheat are plentiful and can be used for a number of projects. Worldwide, wheat straw is widely available and reasonably priced. It might be applied to the production of biodegradable plastic. It may lower the cost of

producing biodegradable plastic and increase its market value due to its low cost, ease of storage, and high mm. Compared to plastic made from conventional materials, plastic made from wheat straw is far more efficient.

One type of environmentally friendly plastic made from straws can be used for packaging and single-use bottles. Biodegradable plastic could be produced with 5% of the annual straw production. Wheat straw contains lignin, which is an important component that can be used to make plastic. Plastic products made from wheat straw can break down in as little as six to nine months or, at most, two years at nearby industrial composting sites. Making biodegradable plastics could help reduce environmental pollution.

2.1.1 Composition

It includes 49%-79% of wheat straw, 19%-49% of thermo-plastic plastics and 2%-4% of adjuvant.

The adjuvant described is one type of the following components: lubricating agent, plasticizer, UV-ray-resisting agent, anti-oxidant, filling agent, reinforcing agent, fire-retardant, anti-static agent, coupling agent, and binding agent. The described wheat straw can be wheat straw and wheat straw leaf of fruiting body or their mixture.

2.1.2 Methods

- Step 1: Wheat straw cutting
- Step 2: Process of drying
- Step 3: Pulverizing the substance to 20-300 meshes
- Step 4: Adding the wheat straw power into mixer
- Step 5: Mixing it with plastic powder and adjuvant
- Step6: Homogenizing the substance
- Step 7: Mixing
- Step 8: Extruding
- Step 9: Granulating
- Step10: Cooling
- Step 11: Solidifying and making them into the invented wheat straw plastics composite material.

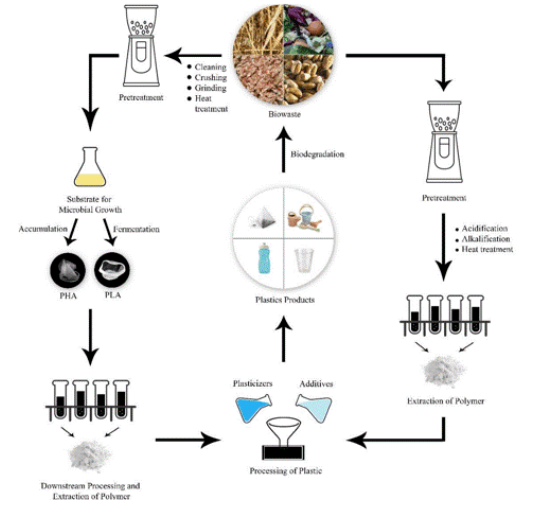

Fig. 2. Any biowaste manufacture process

2.1.3 ENVIRONMENTAL IMPACT OF WHEAT STRAW PLASTIC

Wheat plants use photosynthesis to take carbon dioxide from the atmosphere, just like any other plant. Compared to the manufacture of synthetic plastics made from petroleum, the production of bioplastics uses less energy. As a result, there are less carbon dioxide emissions into the atmosphere.

2.1.4 BENEFITS OF WHEAT STRAW

- Plastic straw made of wheat is entirely biodegradable.The product composed of wheat straw plastic is simple to add to your compost bin, and it will completely break down within three to six months. In commercial or municipal settings, it breaks down more quickly.
- Goods manufactured from plastic derived from wheat straw are sustainable, renewable, and recyclable. It can also be melted down again to create pulp, and it can be recycled into new goods repeatedly.
- The wheat straw's natural fibers are robust enough to not need any additional chemicals. Thus, goods manufactured from plastic derived from wheat straw are natural, allergy-free, and BPA-free.
- Compared to traditional plastic, wheat straw plastic emits significantly less carbon dioxide and requires significantly less energy during manufacturing.

Fig. 3. Sugarcane Bagasses

2.2 Sugar Cane Bagasses

Sugarcane bagasse is a leftover material that is collected during extraction of juice from sugarcane.The sugarcane bagasse consist of 50% cellulose, 25% hemicelluloseand 25% lignin Sugarcane bagasse has become an important constituent of bio-degradable pacakaging,bags ,containers and many more.waste from the combustion process in the form of ash amounts to approximately 20%wt of bagasse.Bagasse has a moisture content between 45 and 55 % by wt.

2.2.1 Composition

SUGARCANE BAGASSES AND ITS MAIN COMPONENTS

2.2.2 Methods

The manufacturing process of converting sugarcane bagasse into plastics typically includes several steps .

2.2.3 Harvesting and Extraction

Presented in Fig 5.

2.2.4 Bagasse Preparation

Presented in Fig 6.

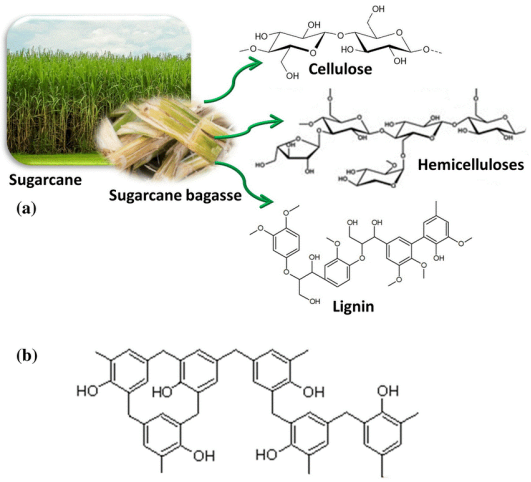

Fig. 4. Components of sugarcane bagassess

Fig. 5. Harvesting and Extraction

2.2.5 Pulping and pulp treatment

Presented in Fig 7.

2.2.6 MOULDING AND EXTRACTION

This process involves techniques like moulding ,extrusion,injection for shaping materials such ascarry bags. Presented in Fig 8.

The average market price of sugarcane bagasse in India is RS 1/ Kilogram.

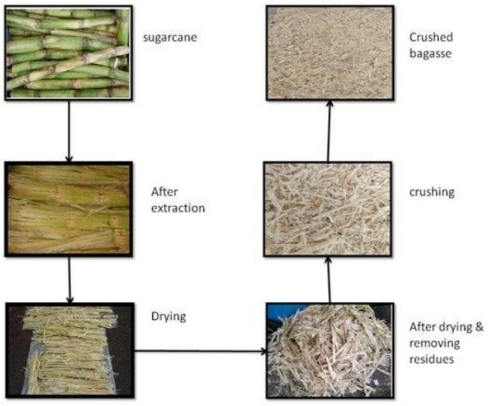

Fig. 6. Bagassess preparation

Fig. 7. Pulping and pulp treatment

2.2.7 BENEFITS OF SUGARCANE BAGASSE

- Bagasse is a sustainable product because it is sourced with very little impact on the environment.
- It can be easily replenished because the residue can be gained after every harvest.
- Due to the prevalence of sugarcane crops in several countries , bagasse material can be easily obtained.
- From every tone of sugarcane stalks that are crushed, approximately 30 tons of bagasse can be obtained

2.2.8 PROPERTIES OF SUGARCANE BAGASSES

- WHAT HAPPENS WHEN SUGARCANE BAGASSESS ARE BURNED?

The results indicate that CO concentrations ranged from 34 to 311ppm,the NOx concentrations from 8 to 80 ppm ,while CO2 reached values from 6000 to 26000 ppm.

Fig. 8. Moulding and extraction

- WHAT HAPPENS WHEN WHEAT STRAW IS BURNED?

In the head fire burning, 477.78 kg of contaminants, composed of 68.26 kg PM, 397.12 kg CO, and 12.41 kg CH4, are generated.

3 Conclusion

The innovation of wheat straw plastic and alternative from plastic by sugar cane, the climatic changes goal is achievable.

Plastic free India is an achievable goal, but it requires collective effort by embracing eco-friendly alternatives, leveraging technology ,and fostering awareness we can pave the way for a cleaner, healthier, and plastic free India which will help to overcome the climate change related health perspectives like respiratory symptoms to adverse neurological effects [1], [2].

Non-biodegradable plastics have been outlawed in a number of nations because of public concern over their grave effects on the environment and agriculture, particularly in developing nations like Bangladesh, India, Pakistan, and South Africa. We have recommended plastic substitutes for pharmaceutical packaging in this review that will aid in regulating climate change related health perspectives [3], [4], [5].

Fig. 9. Coin

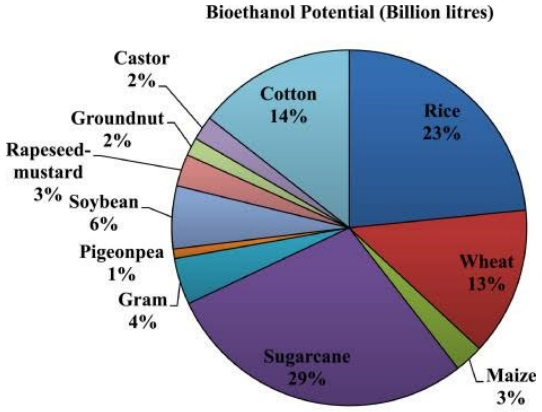

Fig. 10. Residues

Properties	Value (w/w %)
Moisture	9.1
Ash	5
Sugar	1.23
Protein	2.65
Acidic number	0.5
Lignocellulosic composition	**Value (w/w %)**
Extractive	0.8
Cellulose	42.5
Hemicellulose	33.7
Lignin	23

Fig. 11. POLLUTION CAUSED BY SUGARCANE BAGASSE AND WHEAT STRAW PLASTICS

References

[1] Provost GP. Needed: An 'Article Bank' for Pharmacy. American Journal of Health-System Pharmacy. 1968 Mar;25(3):109–113. Available from: http://dx.doi.org/10.1093/ajhp/25.3.109.

[2] Montero G, Coronado MA, García C, Campbell HE, Montes DG, Torres R, et al. In: Wheat Straw Open Burning: Emissions and Impact on Climate Change. InTech; 2018. Available from: http://dx.doi.org/10.5772/intechopen.76031.

[3] Environment International. 1988 Jan;14(4):XII. Available from: http://dx.doi.org/10.1016/0160-4120(88)90062-1.

[4] Montero G, Coronado MA, García C, Campbell HE, Montes DG, Torres R, et al. Wheat Straw Open Burning: Emissions and Impact on Climate Change. Global Wheat Production. 2018 Aug. Available from: http://dx.doi.org/10.5772/intechopen.76031.

[5] Dutta A, Patra A, Hazra KK, Nath CP, Kumar N, Rakshit A. A state of the art review in crop residue burning in India: Previous knowledge, present circumstances and future strategies. Environmental Challenges. 2022 Aug;8:100581. Available from: http://dx.doi.org/10.1016/j.envc.2022.100581.