

Exploring Sustainable Alternatives: Liquid Wood Packaging for Ecofriendly Food Packaging

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Abstract

In the modern era, environmental problems are increasing due to various reasons. Food packaging is one of the reasons why environmental problems take place. The present research paper delved into the potential of liquid wood as an innovative and ecofriendly alternative for chips and snack wrappers. Cellulose, hemp, flax, and lignin—substances once largely used for the creation of paper—are blended to create liquid wood. Many of the plastic-based products we regularly use can be replaced by liquid wood owing to its unique features. Through a comprehensive examination of its production process, material properties, and end-of-life considerations, we assessed the potential of liquid wood to reduce the ecological footprint associated with single-use packaging. Our research employed life cycle assessment methodologies to compare the environmental impacts of liquid wood packaging with traditional materials commonly used in the snack industry. Preliminary findings suggested that liquid wood exhibits promising attributes in terms of biodegradability, resource renewability, and reduced carbon emissions. Furthermore, we discussed potential challenges and opportunities for the widespread adoption of liquid wood packaging in the food industry, emphasizing the need for a sustainable shift in packaging practices. The present study contributed valuable insights to the ongoing discourse on environmentally friendly packaging solutions, offering a foundation for future research and practical applications in the pursuit of more sustainable snack packaging alternatives.

Keywords: Environmental, liquid wood, methodologies, resources, snack packaging

INTRODUCTION

In recent years, escalating environmental problems have made to find an alternative source for conventional packaging material. Due to the harmful impact of packaging materials or other non-biodegradable substances, it has become the need of the hour to find an alternative source for packaging. Liquid wood is now considered as an option, which is a better alternative source than plastic. The overarching goal of the present study was to assess whether liquid wood can alleviate the ecological footprint associated with snack packaging. The present research suggested that liquid wood possess

commendable attributes, including biodegradability, renewability of resources, and a potential reduction in carbon emissions. Through the present research, we highlighted the important and useful merits of liquid wood which can act as an alternative source for food packaging materials including biodegradability, renewability of resources, and a potential reduction in carbon emissions [1].

Scientists at the Fraunhofer Institute for Chemical Technology (ICT) in Pfinztal, Germany, invented liquid wood. Arbofill, Arboblend, and Arboform are the three varieties of liquid wood substances that are now available. Arbofill and Arboblend are only partially biodegradable,

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whereas Arboform is completely biodegradable. The information is not yet available and research on differential calorimetry and micro indentation is still ongoing [2].

EFFECT OF PLASTIC PACKAGING IN FOOD INDUSTRIES

Over the past few decades, family units have gotten to be progressively active, and comfort has ended up a vital calculation in buys. At the same time, the sum of bundling of a person nourishment item or other shopper thing has expanded quickly in cutting-edge times. Though bundling offers benefits in the nourishment industry for their nourishment supply to buyers where they offer security and comfort, and diminishes burglary [3], it moreover comes with a few impediments. Bundling can be bulky, costly, and naturally harmful over its life cycle.

Cost

Packaging can play a part in getting client consideration and may indeed include esteem to an item as it draws the interest of shoppers to purchase their product. It has also taken a toll on generation and the inevitable retail cost. Concurring to know this, bundling can speak to as much as 40% of the offering cost of items in businesses such as the corrective industry. Unused bundling can be costly to create, including the fetched items.

Landfill Impact

Packaging is mindful for critical parcels of the squander stream. Concurring to the Ashland Nourishment Agreeable, bundling is dependable for approximately one third of the metropolitan squander in the joined together States. A few squanders can be reused, but numerous materials are not suitable for reusing. Post-consumer reused substances are regularly usable as they were in particular settings. For occasion, numerous sorts of reused plastic may not be utilized in nourishment holders, indeed if the unique plastic came from nourishment holders. Much of the squander created by bundling closes in a landfill [4].

Production Footprint

Products with more bundling too utilize more assets in generation. Concurring to Green Living Tips, around 12 million barrels of oil are utilized to make shopping sacks for U.S. buyers each year. Over 10 million barrels are utilized to make water bottles, and one pound of polystyrene (Styrofoam) employs almost two pounds of petroleum stock. Generation moreover requires vitality, ordinarily sourced from burning fossil powers, and may deliver and discuss water contamination.

In the bundling industry, nourishment bundling accounts for 50% of the plastics inferred from fossil powers. When food is thrown away, the packaging it came in usually gets discarded too. Plastics derived from fossil fuels persist in the environment and require many years to decompose. Global biopolymer production has increased from just under 300,000 tons in 2009 to 2.11 million tons in 2019, with projections indicating a rise to 2.42 million tons by 2024. In 2015, the global market for bioplastics consisted of approximately 64% biobased non-degradable plastics and 36% biodegradable plastics. There is an anticipated increase in the proportion of biodegradable polymers to address environmental concerns regarding pollution, with the share of biodegradable plastics rising to about 56% in 2019 (Figure 1).

Asia was the major maker of book-keeping for 45% of worldwide generation. The arrival utilized to develop renewable stocks for bioplastic generation stood at 0.79 million hectares which is 0.02% of the worldwide rural region and this will stay the same despite the anticipated development of bioplastic generation.

As such, this will have no effect on 97% of the worldwide agrarian zone which is being utilized for field, nourish, and nourishment. Africa is to make its stamp as it is still slacking in terms of bioplastics generation, despite the accessibility of crude fabric assets (Figure 2).

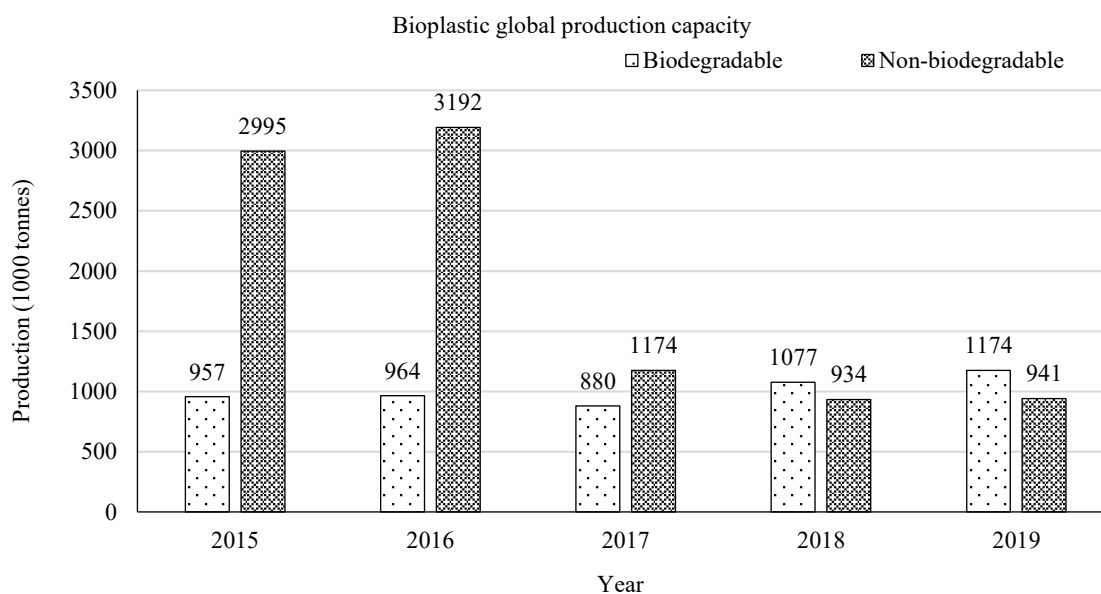


Figure 1. Bioplastic global production capacity.

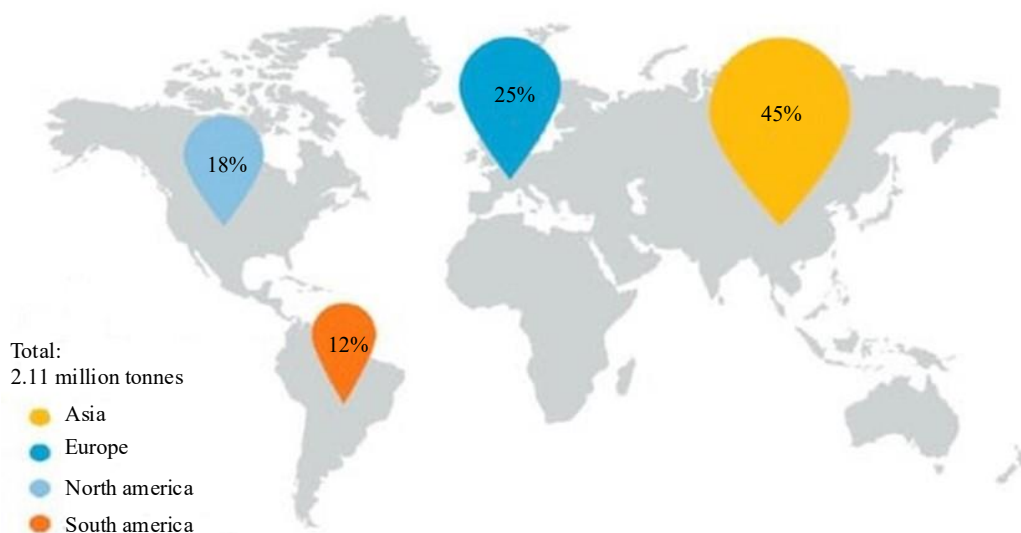


Figure 2. Countries producing bioplastics.

BENEFITS OF LIQUID WOOD

A number of substances from nature, including cellulose—the fibers of flax, hemp, and lignin—that were formerly utilized in the making of paper combine to form liquid wood. It has the ability to replace many plastic goods we currently use given its special qualities. The greatest aspect is that it has no negative side effects and is entirely organic and secure for human health. Liquid wood technology can fix broken wood and make it strong and long-lasting again. It can handle a lot of pressure and is resistant to bugs and the weather. Not using water and soap during the process helps keep more of the material and makes bonding work better. Switching to liquid wood will help the food packaging industry stop using regular plastics, which have harmed the environment a lot. This technology can help cut down on the use of plastic polymers that don't break down and fix the damage they do to the environment and biodiversity [5].

Structural Strength

Liquid wood starts as a viscous liquid that can be molded or cast into various shapes. When it hardens, the intertwined fibers make a strong matrix such as natural wood. The biopolymer binder enhances the cohesion between the wood fibers, contributing to its structural integrity.

High-Strength

The combination of wood fibers and the biopolymer creates a composite material that can possess high strength. By controlling the ratio of wood fibers to biopolymer and adjusting the manufacturing process, the strength properties can be tailored to meet specific requirements. Liquid wood can exhibit comparable or even superior strength to traditional wood materials.

Durability

Liquid wood exhibits resistance to rot and decay similar to that of natural wood, owing to the intrinsic characteristics of the wood fibers and the protective qualities of the biopolymer binder. This material can endure moisture, ultraviolet (UV) radiation, and temperature variations without considerable deterioration. Additionally, appropriate sealing or finishing can further improve its durability by offering extra protection against environmental influences.

Weather Resistance

The biopolymer component in liquid wood can act as a barrier against moisture, preventing water from penetrating the material and causing swelling or warping. Additionally, the inherent properties of wood fibers contribute to the material's ability to withstand weathering, including exposure to rain, snow, and sunlight [6]. Liquid wood can be formulated to resist fading, discoloration, and degradation caused by prolonged exposure to harsh outdoor conditions.

Insect Resistance

The dense structure of liquid wood, coupled with the chemical composition of biopolymer binder, can deter insect infestation [7]. Unlike natural wood, which may be susceptible to termite or wood-boring insect damage, liquid wood provides a less hospitable environment for pests. Incorporating additives or treatments during the manufacturing process can further enhance its insect-resistant properties [5].

ENVIRONMENTAL BENEFITS

Reduction of CO₂ Emissions

The manufacturing of plastics require substantial resources. In comparison, environmentally-friendly plastics are created using more efficient processes, resulting in decreased consumption of resources such as raw materials, electricity, and water. Additionally, reducing processing helps to lower the carbon dioxide emissions that enter the atmosphere. It is essential to implement all feasible strategies to reduce emissions. Therefore, ecofriendly plastics seem to hold promise in combating climate change by replacing traditional plastic packaging and other uses [8].

Safe for Both People and Animals

Numerous connections exist between traditional plastics and health issues, which also pose a threat to wildlife and marine ecosystems. Traditional plastics frequently include dangerous chemicals such as Bisphenol A (BPA) and polyvinyl chloride (PVC), which can contaminate food and drink and perhaps impair children's development. Eco-friendly plastics, on the other hand, are safer for the environment, animals, and people because they are made up of natural materials and have few or no hazardous compounds [7, 9].

Less is More and Recycling is Simple

Eco-friendly plastics are often thinner than traditional ones, so we need less material to make them. Despite being lightweight, they are still very strong. Since they are made from natural ingredients, they are easier to recycle and dispose of, making them more environmentally friendly. Also, they can be repurposed into many other useful products after their first use.

Reduced Risk to Animals

We all know how harmful plastic waste can be for animals and marine life. Eco-friendly plastics are much less dangerous, but they can still cause problems if we do not dispose of them properly. Sadly,

some waste will always end up in nature. The good news is that eco-friendly plastics breakdown much faster, so they are likely to disappear before causing serious harm.

Reduce Waste

Conventional plastic still harms the environment even after hundreds of years have passed since it breaks down. Eco-friendly plastics, on the other hand, degrade much faster and can often be reused. As a result less garbage will accumulate in our homes and landfills [9]. Making the conversion to biodegradable plastic can significantly help free up space and lower our impact if landfill space reduces, as we are currently experiencing in the US.

Save Money

Traditional plastic is economical because it is generated in huge quantities. Since it is not currently made on the same scale, eco-friendly plastic can nevertheless save producers' money. Less material is used since it usually needs less packaging. Additionally, the manufacturing process is more effective, which also decreases expenses. Both manufacturers and consumers may profit from the reduction in these expenses. It is far superior overall because it decreases the high expenses of waste disposal and recycling.

Use Less Oil

We use a lot of plastic that conveys that a lot of oil is used to create it. But oil drilling puts different species at risk, damages habitats, and hurts the environment. In addition to the carbon emissions, there is a chance of contamination and oil spills. Sustainable or environmentally friendly plastics reduce our need on oil. This translates to improved protection for ecosystems and wildlife, fewer catastrophic events, and less harm to the earth.

Eco-Plastics Lead to Enhanced Business Practices

Consumers have significant impact; brands react to what people have to say. Consumers today are more environmentally sensitive and deliberate in buying things. Businesses will be forced to react if more buyers start expressing fears and choose sustainable plastic products [10]. This may encourage companies to reconsider their containers and choose for environmentally sound options.

CONCLUSION

Liquid wood packaging represents a significant and eco-friendly alternative to conventional plastic packaging. Derived from natural and renewable resources, liquid wood offers several advantages, including durability, resistance to moisture and pests, and the ability to decompose naturally. Unlike traditional plastics that often persist in landfills for hundreds of years, liquid wood breaks down more easily, reducing long-term environmental harm.

One of its most important benefits is its lower environmental impact, as it produces fewer harmful gas emissions and reduces dependency on non-renewable resources like oil. This not only helps in controlling pollution but also minimizes risks to humans, animals, and ecosystems, since it does not contain the toxic substances often associated with plastics. Additionally, liquid wood is easier to recycle and requires less effort for safe disposal, which further supports waste management practices.

The adoption of liquid wood packaging can play a vital role in transforming industries, especially the food packaging sector, where sustainability is becoming increasingly important. With growing awareness among consumers about environmental issues, businesses are likely to adopt such greener solutions to meet expectations and improve their overall practices.

Overall, liquid wood packaging offers a sustainable and practical pathway toward reducing plastic pollution and creating a cleaner environment. By embracing such innovations, society can move closer to its goals of environmental protection and resource conservation. It provides a promising balance

between functionality and sustainability, ensuring that human needs are met without compromising the well-being of the planet.

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