

Why are pallets made with UBQ[™] the greener choice?

Understanding the Environmental Footprint of Shipping Pallets Made with Wood, Plastic, or UBQ™





EXECUTIVE SUMMARY

Standard wooden shipping pallets can generate up to 127 times the carbon emission of pallets made with UBQ[™], a bio-based thermoplastic converted entirely from organic and unrecyclable waste. A comprehensive analysis comparing shipping pallets made from wood, plastics, and UBQ[™] demonstrate the magnitude of environmental impact made from simple material substitutions. This analysis encourages a holistic evaluation that takes into consideration raw materials, carbon footprint, and recyclability.



INTRODUCTION

Shipping pallets provide support and stability for millions of products that are transported worldwide by land, air and sea. Indeed, pallets are used to transfer almost everything from point A to B. Serving such an essential role in supplying global populations with goods, the worldwide pallet market reached a value of US \$82 billion in 2021¹, and by 2027 is estimated to reach \$110.5 billion.

This growth has brought into question the sustainability of pallets produced with wood versus oil-based plastics, not only in respect to carbon footprint, but also taking into consideration the end of life and circularity of these materials. Recent years have shown a rise in pallets produced from recycled materials, but questions remain as to whether these are the greenest options when novel advanced materials have been introduced to the market.

More sustainable material solutions are now available. We will examine how a simple material swap in shipping pallets highlights the impact a single material substitution can have on a fundamental item used across global supply chains.

The aim of this case study is to compare the differences between pallets made from wood, plastics, recycled plastics and UBQ^{TM} , with a focus on circularity.



Short Overview: Wood, Virgin or Recycled HDPE, and Pallets made with UBQ™

To effectively compare the different materials used to produce pallets, each material must first be analyzed individually.

SHIPPING PALLETS MADE FROM WOOD

Ten billion pallets are in circulation around the world, 95% of which are made from wood. The assumed loss rate is 10% annually. Pallets break, and the majority of those are discarded and not recycled or recirculated. These pallets end up in landfills, releasing methane gas in their decomposition, adding to greenhouse gas emissions. Pallet wood can take up to 13 years to decompose due to the way it is processed.

Wooden pallets have a relatively high carbon footprint due to material production and manufacturing. They are less durable than plastic pallets and require the use of pesticides to reduce the risk of insect or termite infestation. These chemicals are toxic for the environment and carry a carbon footprint of their own².

In the past, production of wooden pallets played a significant role in deforestation; this is still a cause for concern today³. According to research, pallet production uses 43% of hardwood and 15% of softwood produced in the U.S.⁴ While there has been a significant move towards recycling, the process is complex due to infestation and contamination, especially when pallets are damp and have leftover nails inside the wooden beams. On a global scale, one of the greatest challenges to recycling wooden pallets is simply retrieving and moving them to recycling facilities⁵.

SHIPPING PALLETS MADE FROM VIRGIN HDPE OR RECYCLED HDPE

Calculating the environmental impact of plastic pallets depends on whether they are made from virgin oil-based resins or recycled plastics. When pallets require extraction of natural gas or virgin oil-based resins, their carbon emission greatly increases⁶.

Plastic pallets carry the highest environmental footprint in their production phase due to the extensive energy required to extract fossil fuels needed to produce HDPE.

To note, pallets made from 100% recycled plastics have a lower carbon emission footprint than virgin plastic but are still no match to the further reduced emissions of recycled plastic pallets made with UBQ[™].

Durability is in the material's favor, as plastic pallets, whether virgin or recycled, have a better shelf life compared to wooden pallets and can travel more than 200 round trips before being taken out of service.

SHIPPING PALLETS MADE FROM WASTE-BASED UBQ™

The greenest choice for the pallet industry are plastic pallets made with UBQ[™], a bio-based thermoplastic converted entirely from unsorted household waste, including all organics and mixed plastics. While UBQ[™] is certified to consist of 100% recycled content, it differs to recycled plastics in that it delivers consistent quality and availability. UBQ[™] is the result of an advanced technology that breaks organic waste down into its basic particles and reconstructs it into a new thermoplastic matrix. Despite variability in the waste stream, UBQ[™] maintains a homogeneity that cannot be achieved in recycled plastics. In contrast to the global volatility of supply for post-consumer recycled content, the production of UBQ[™] relies solely on MSW (municipal solid waste) as feedstock, which is an abundant resource with potentially unlimited availability.

According to Quantis, UBQ[™] is the most climate-positive thermoplastic on the market. Every ton of UBQ[™] diverts 1.3 tons of landfill waste and prevents up to 11.7 tons of CO₂eq. UBQ[™] is a composite material that is delivered to compounders or clients in a standard tablet format, that is compatible with all major polymers and existing manufacturing processes. Furthermore, implementation of UBQ[™] into existing manufacturing systems requires no adaption costs or changes to tooling and design.

The industry's carbon footprint can be significantly reduced by substituting even a small fraction of virgin or recycled plastics in the manufacturing of logistics pallets. UBQ[™] closes the loop between the ecosystem of waste and the ecosystem of materials, with potential applications that extend far beyond shipping pallets. Looking singularly at supply chains, UBQ[™] can be incorporated into shelving, display stands, bins, structural builds, and more. When designing for circularity, shipping pallets made with high contents of UBQ[™] rank first place.





ANALYSIS AND EXPLANATION

The table below compares the carbon footprint per pallet type produced. These numbers include both the material used and the manufacturing processes involved (use of electricity, water, etc.).

Pallets made from recycled plastics and UBQ[™], as shown in the table below, are the most environmentally conscious choice for the supply chain industry.

Pallet Material	Carbon Footprint (kg CO2eq/pallet [GWP20])		
	Materials	Manufacturing	Total Materials + Manufacturing
Wood	1,134.55	267.06	1,401.62
Virgin HDPE	48.28	30.38	78.66
Virgin HDPE + UBQ™	14.00	30.38	44.38
Recycled HDPE	8.91	30.38	39.29
Recycled HDPE + UBQ™	-19.34	30.38	11.04

TABLE OF RESULTS⁷

The highest carbon footprint came from pallets manufactured with wood, which created 1,401.62 kgs of CO₂eq emissions per pallet produced. A standard wooden GMA pallet is 48×40 in size and weighs about 13 to 15 kgs⁸.



It must be noted that according to the EPA, in 2018, American landfills received 12.1 million tons of wood, constituting eight percent of all municipal solid waste landfilled that year⁸. That same year, the EPA also estimated that 3.1 million tons of wooden pallets were recycled, only 17.1 percent of the total⁸.

Put simply, this means that:

Americans cut down millions of trees each year to manufacture pallets, and then discard more than 80 percent of them.

A single pallet made using virgin HDPE produced 78.66 kg of CO₂eq emissions, the second largest carbon footprint following wooden pallets. Virgin HDPE made with UBQ[™], however, had better results, but still produced 44.38 kg of CO₂eq emissions per pallet.

Pallets made with recycled plastics or resins i.e., HDPE, produce 39.29 kg of CO₂ emissions per pallet – not significantly lower than that of virgin HDPE. Pallets produced with recycled HDPE together with UBQTM, however, have the lowest carbon footprint. The materials formulation used (recycled HDPE and UBQTM) is climate-positive. The carbon footprint of manufacturing these pallets is similar to that of virgin resins, however, due to the climate positivity of the materials, the total emissions per pallet added up to only 11.04 kg of CO₂eq.

This calculation considers a load of 10 percent to 15 percent UBQTM in the final pallet production. Similar results can be achieved if calculating for a pallet whose base resin is polypropylene rather than HDPE. Imagine the results if more UBQTM were to be used, in all the pallets across the world, and then multiply this impact to account for other durable products that may integrate UBQTM as a plastic substitute.

Assessing the Opportunity Impact

The table below (figure 1) enables us to take a hypothetical look at the opportunity impact of replacing wooden pallets with plastic pallets incorporating 50 percent UBQTM. As shown, this replacement suggests between 105-150 million tons of avoided CO₂eq. In this hypothetical calculation, we are also diverting 26 million tons of waste from landfill and converting it into a valuable resource as an alternative to cutting down trees.

FIGURE 1: CALCULATION OF PALLETS INDUSTRY CLIMATE IMPACT AND POTENTIAL REDUCTION WITH UBQ™





CIRCULAR ECONOMY

The idea of circular economy is to turn linear consumption models into a closed loop. When items like shipping pallets reach their end-of-life, they are to be repaired, reused, recycled, or returned to nature as nutrients rather than becoming various forms of environmental pollutants.

UBQ Materials has developed a circular end-of-life solution for household waste that is not fit for recycling and would otherwise be destined to landfills, incineration, or dumped directly into waterways. The UBQ conversion is able to processes the entire waste stream, including mixed plastics, cardboard, food scraps, baby diapers and more, and transform it into a plastic substitute that is highly recyclable.

As dictated by circular economy requirements, UBQ[™] is capable of being looped back into its original material value, to be utilized over and over. Unlike existing oil-based resins, UBQ[™] can be recycled more times without degrading, efficiently addressing the waste epidemic and reframing waste as a valuable resource. With UBQ[™], local waste can drive local production over and over again.



LANDFILL USE REDUCTION AND PREVENTION OF METHANE EMISSIONS

Avoiding the decomposition of organic materials in landfills, UBQ[™] prevents methane emissions, a greenhouse gas 86 times more potent at trapping heat over a 20-year time scale than carbon dioxide. Less waste in landfills means less methane emissions produced, a measure that directly and significantly advances the fight against climate change.

A Lifecycle Assessment (LCA) done by Quantis International, an accredited sustainability and LCA auditor, showed that for every ton of UBQ[™] that is produced, there is a prevention of up to 11.7 tons of CO₂eq, naming it the most climate-positive thermoplastic material in the market (see figure 2).



FIGURE 2: THE MOST CLIMATE-POSITIVE THERMOPLASTIC IN THE MARKET

AVAILABLE AND COST-COMPETITIVE

Due to the regrettable abundance of landfill-destined waste worldwide, a steady supply of UBQ[™] is rooted in a feedstock source that is globally available, and continually renewed by normal modern consumption.

UBQ[™] is competitively priced to meet market costs of virgin plastics. Beyond price parity, UBQ[™] is an easy material swap that is suited to existing manufacturing processes and does not require any additional CAPEX or modification to machinery, tooling, or designs.

Pallets made with a combination of UBQ[™] and recycled HDPE are by far the most environmentally friendly option for the supply chain industry.

According to these environmental calculations, pallets made from wood should be the industry's last choice, limited to long-distance one-way applications, followed closely by traditional oil-based virgin resins.

Implementing UBQ[™] into shipping pallets, and thousands of other possible applications, means no difference in cost, quality, appearance, or performance, but all the difference to the environment.

Thinking globally, we can extrapolate that shipping pallets made with plastics and UBQ[™] are just one example of UBQ's potential positive impact on the environment. This one single item can make a huge dent in the fight against climate change and the transition towards a thriving circular economy.



Imagine the endless possibilities.

CITATIONS

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