



Evaluation of Plastic Depletion by Replacing Eco-Dining Palm-Plates (*Areca Catechu*)

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<i>Article History</i>	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 04 Nov 2023	<p>Background: In today's world, take-away materials predominantly consist of non-biodegradable plastics, known for their longevity and the release of harmful toxins during decomposition. To tackle this problem, the following article delves into the advantages and substitutes for plastic takeaway utensils and tableware, focusing on products made from palm (areca) and coconut tree by-products. It delves into the revival of traditional methods and knowledge rummage-sale in the southern then central parts of the India to create sustainable dining products. The article includes a market analysis, design considerations, life cycle analysis, and in-depth research on fabrication. Disposable plates, such as those made it from the polythene, polypropylene, polystyrene, polycarbonate, and polyvinyl chloride pose health risks, As a result of the release of noxious compounds, including melamine, vinyl chloride, biphenyl A, and phthalates. Therefore, an increasing trend is emerging in favour of utilizing use and throw plates crafted from plant leaves, which are both renewable and decomposable, however it is offering substantial antioxidant and medicinal properties. Results: In India, the classical way of using leaf dining plates carries profound cultural values, religious beliefs, medicinal, and socio-economic significance. The art of crafting these leaf plates serves as a livelihood for tribal communities residing in the states such as Orissa, Madhya Pradesh, Chhattisgarh, and Andhra Pradesh, These palm plates hold a crucial role in the offerings presented during religious rituals (Naivedyam) and the distribution of Prasadam to devotees. They find extensive use in serving meals at weddings, religious festivities, communal gatherings, and a wide array of other events. India embraces a variety of plant leaves not just as dining plates but also for their utility in wrapping, steaming, grilling, frying, and as materials for food packaging. Conclusion: In summary, biodegradable palm plates possess significant promise in the global market, granted they adhere to quality, design criteria. To promote the continued use of Leaf plates and discourage the adoption of plastic alternatives, it is imperative for the government to establish requisite regulations, which local authorities should rigorously enforce. Furthermore, spreading awareness among school and college students regarding the importance of these leaf plates is pivotal for nurturing their sustained adoption.</p>
CC License CC-BY-NC-SA 4.0	Keywords: Palm plates, Antioxidant, Coconut

1. Introduction

In recent decades, a heightened awareness of ecological issues has prompted professionals and researchers to seek sustainable and eco- friendly materials that can replace synthetic non-biodegradable polymers in various applications. Currently, there is significant interest in developing biodegradable products using non-food materials. Among these materials, natural plant fibres offer numerous advantages: they are abundant, renewable, lightweight, and cost-effective, require minimal processing, and, most importantly, biodegradable [1]. Areca palm sheath fibres, in particular, hold great potential for direct use or as fillers in composites, leading to the creation of biodegradable and eco-friendly

materials. This article provides an overview of the growth, market, production process, and future prospects of biodegradable dishware made from compostable areca leaves [2].

The Impact of Plastic in Past Decades:

In previous decades, the plastic industry experienced unprecedented growth, leading to the widespread use of plastic plates and cutlery. However, these plastic products have had severe environmental consequences, causing pollution and potential health hazards, including diseases such as cancer. Recognizing these issues, the Indian government has initiated measures to combat plastic waste by introducing eco-friendly alternatives like palm plates and wooden cutlery. The use of plastic tableware in a country known for its diverse culinary traditions has raised concerns about its environmental impact, especially as single-use plastics have become ubiquitous in street food vendors, restaurants, and catering units. This study targets to explore the concept of biodegradable cutlery and tableware and its relevance to environmental sustainability [2]. It relies on secondary data to examine various types of biodegradable alternatives that can replace single-use plastics, highlighting their advantages and eco-friendliness [3].

Global Impact of Plastic Usage:

As of 2018, global plastic production exceeded 380 million tons annually, with a substantial portion ending up in the environment. This plastic waste has led to a surge in plastic pollution, harming ecosystems and wildlife. The demand for plastic cutlery is staggering, with the United States consuming 40 billion plastic utensils annually, and India discarding 120 billion pieces each year. In 2017, the global plastic cutlery market was assessed at \$2.62 billion, with a forecasted value expected to reach \$3 billion by 2025. Half of the world's plastics originate from Asia, with China contributing 29% to global plastic production. This excessive use of plastics not only depletes natural resources but also poses long-term environmental challenges [4].

Plastic consumption has surged fourfold in the last three decades, primarily fuelled by growth in emerging economies. From 2000 to 2019, global plastic production doubled, reaching a staggering 460 million tonnes. This surge in plastic production is responsible for 3.4% of worldwide greenhouse gas emissions.

During the same period, global plastic waste generation also more than doubled, reaching 353 million tonnes in 2019. A substantial share of this waste, approximately 66%, is attributed to plastics with brief lifespans of less than five years. Packaging makes up 40% of this share, followed by consumer goods at 12%, and clothing and textiles at 11%.

Surprisingly, a mere 9% of plastic waste undergoes recycling, and out of the 15% collected for this purpose, 40% ultimately results in residual materials. Additionally, 19% of plastic waste is incinerated, 50% goes to landfills, and 22% finds its way into unregulated dumpsites, open pit burning, or terrestrial and aquatic environments, particularly in economically disadvantaged countries.

Just in 2019, an astonishing 6.1 million tonnes of plastic waste found its way into aquatic ecosystems, with 1.7 million tonnes making its way to the oceans. Consequently, our seas and oceans currently house an estimated 30 million tonnes of plastic waste, while an additional 109 million tonnes have gathered in rivers. This river accumulation signals that plastic leakage into the oceans will endure for an extended period, even if substantial advancements are made in enhancing plastic waste management.

To address this global issue, it is crucial to focus on aligning design principles and regulating chemicals within the plastic value chains. Moreover, an international approach to waste management is essential, necessitating the mobilization of all potential sources of financing, including development aid. This financial support should aim to assist low and middle-income countries in meeting the estimated annual costs of EUR 25 billion to improve their waste management infrastructure. (16)

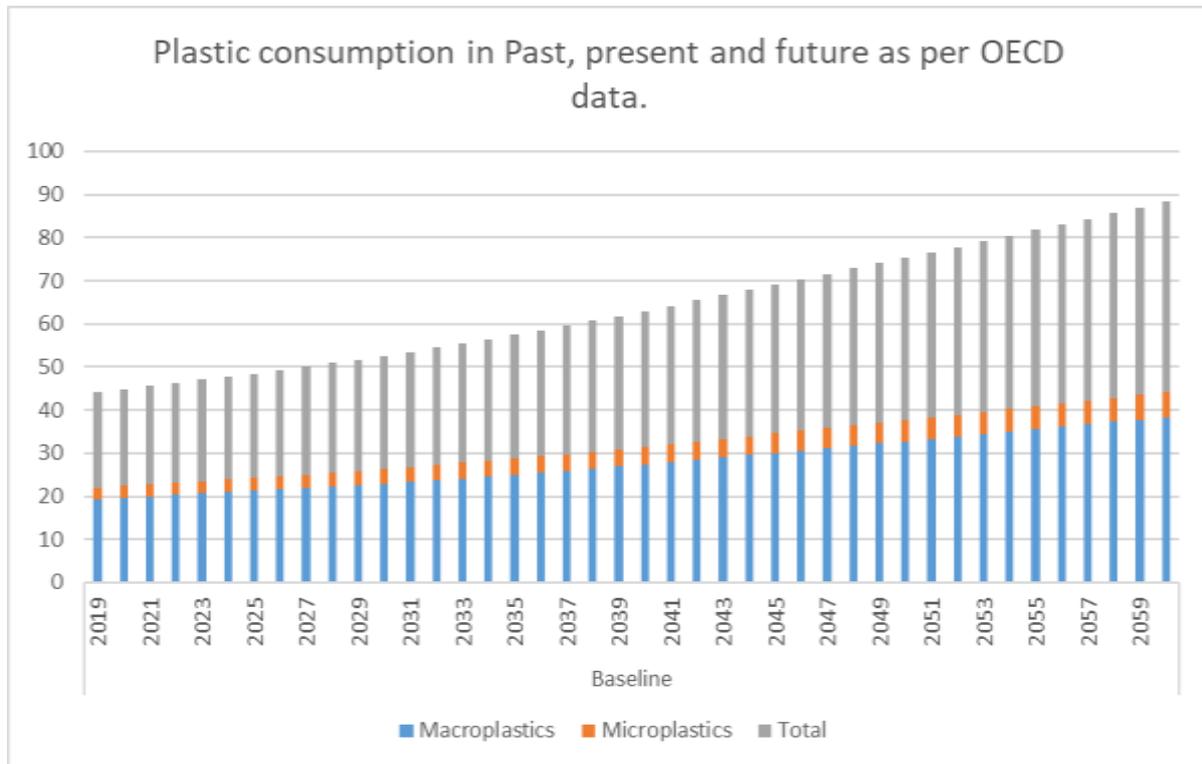


Figure 1: Plastic consumption in past, present and Future as per OECD data

Sources: OECD (2023), "Global Plastics Outlook: Plastic usage impact on environment - projections", OECD Environment Statistics (database), <https://doi.org/10.1787/4ab65392-en> (accessed on 02 October 2023).

Leaf plate trade in India:

In India, the process of making leaf plates typically involves several steps: collecting leaves, drying them, and then stitching them together by hand or using machines to create plates. Leaf collection is usually done by women for nearby forests and by men for more distant areas. Women primarily handle the stitching work at home. Small-scale cottage industries are responsible for the production of these plates. These plates, referred to as "khali," are single-layered and can be used directly by consumers for dining. Alternatively, they can be transformed into thicker plates using heat pressing machines, which are sourced through commission agents, dealers, and traders.

Suitability of the leaves for machine density depends on the factors like their flexibility, fiber content, mechanical strength, type, and venation pattern. Palm plate leaves from trees like sal, addaku, and palasa are commonly used for making saleable leaf plates. Pedal-operated and hydraulic heat comprising machines are used for melding, trimming, pressing, and drying the leaf plates. To make the plate's waterproof, a layer of Low-density polyethylene (LDPE) is sandwiched between the leaves and the underlying cardboard paper or leaves. Cardboard paper is typically made from cotton and old cloth materials.

Palm plates are available in a range of sizes, spanning from 11 to 18 inches in diameter, while cups and bowls come in sizes varying from 3 to 8 inches in diameter. Additionally, partitioned trays and buffet plates are manufactured to cater to market and customer demands, as no rigid standards have been established through the Bureau of Indian Standards (BIS). These cups are useful for serving liquid foods such as soups, cereals, raita, and dal.

It's important to note that these items are not subject to the GST, which is an indirect tax method in India, in accordance with government decisions. In addition, the establishment of this industry does not require necessitate clearance from Local pollution control agencies like the State Pollution Control Board. To safeguard environment and maintain forest cover, state governments impose restrictions on leaf collection, usually limited to a specific period, typically ranging from 4 to 6 months annually. The traditional way of utilizing leaf plates in India has garnered the interest of the European market, with a German company known as Leaf Republic actively involved in the production and importation of both finished leaf plate products and raw materials. Notably, the waste generated from the leaf scraps in the manufacturing process can be repulped to produce eco-friendly paper, offering a cost-effective solution.

Areca catechu

The *Areca catechu* trees, also known as the areca palm, areca nut palm, or beetle nut palm in English, carries various names in various states of Indian languages, including vakka, adakka, adike, puga, supari, pakku, kamugu, and gua. This medium-sized tropical palm boasts a slim, upright, unbranched stem and belongs to the Aracaceae family. It seems to be widespread cultivation in countries like China, India, Bangladesh, Sri Lanka, Malaysia, Thailand, Vietnam, the West Indies, and Indonesia.

The palm leaves of the areca palm are lengthy and palmate, typically measuring around 1.5–2 meters in length. They encircle the stem, forming protective sheaths that come in oblong shapes with varying dimensions. These sheaths can range from 65 to 111 centimetres in length, 23 to 33 centimetres in width, and 2.5 to 5.25 millimetres in thickness. These sheaths exhibit notable tensile strength and have a low calorific value. Comprising cellulose, hemicelluloses, lignin, pectin, and fiber, they serve as an alternative fodder for cattle when wet, and farmers use dry sheaths as firewood. In certain states are Kerala, Tamil Nadu, and Assam, thick naturally fallen sheaths are collected, water-washed, soaked in hot water, and hot-compressed to create disposable plates and cups renowned for their rigidity, density, heat tolerance, and high quality. These products are water-resistant, odourless, suitable for freezer, microwave, and oven use, as well as naturally biodegradable and compostable.

Concerning food safety, these palm plates and cutlery's are apt for single-use with moist food and multiple uses with dry food. It can effectively hold both cold and hot liquids due to their thermal resistance and structural sturdiness. Their durability and wood-like texture make them aesthetically pleasing and ideal for outdoor gatherings, such as picnics. Fig. 1 showcases various shapes of palm plates, which can be utilized for enhancing eco-friendly dining.



Figure:2 Different shapes of plates made by the palm plate to decorate the sustainable dining.

Overcoming Plastic Dependency with Sustainable Biodegradable Cutlery:

The fast-food industry can play a vital role in reducing plastic usage by adopting eco-friendly alternatives, such as biodegradable cutlery and tableware made from palm leaves. These products have significant domestic and international market potential, provided they meet societal expectations in terms of design and quality. Governments should implement regulations and oversee their enforcement to promote the use of palm plates and reduce plastic tableware consumption [5]. Additionally, educational efforts targeting school and college students can help raise awareness of the importance of eco-friendly dining.

Analysis of comparison of impact in plastic and palm plates toxicity level in ecosystem:

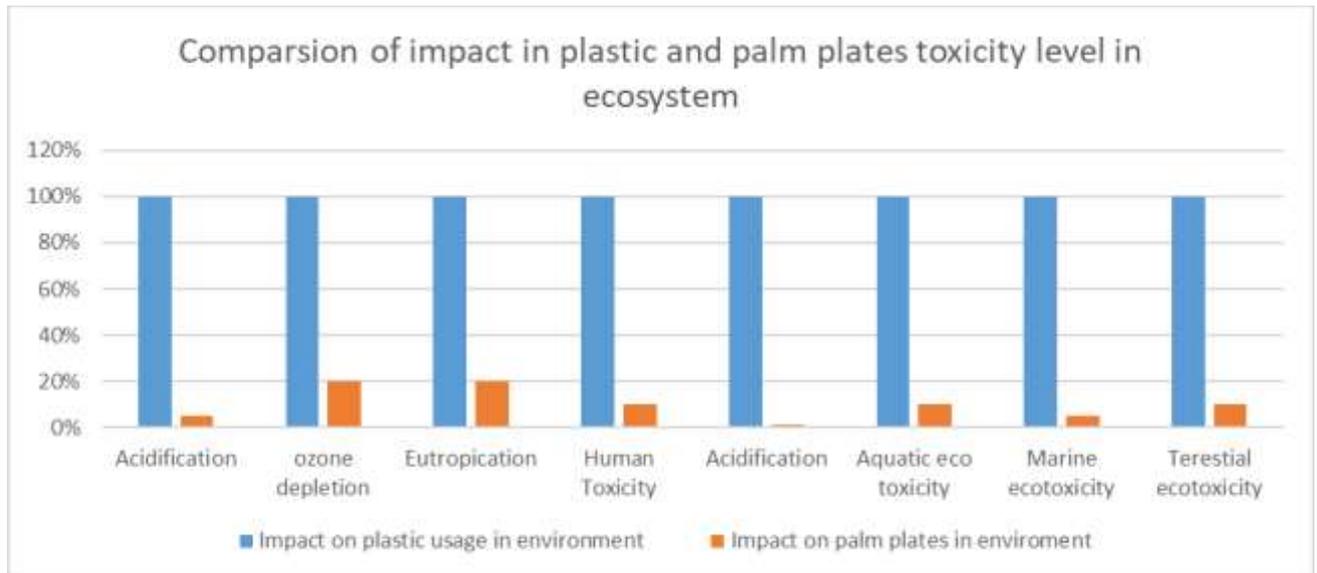


Fig 3: comparison of impact in plastic and palm plates toxicity level in ecosystem.

Sources: Anirudh *et al.*, 2020

Benefits of Biodegradable Palm Plates and Cutlery: Biodegradable palm plates and cutlery offer a multitude of benefits:

1. **Environmental Impact:** Made from natural materials, they break down naturally, reducing plastic waste in landfills and oceans and lessening pollution.
2. **Health:** They are generally free from harmful chemicals, ensuring food safety.
3. **Sustainability:** Created from renewable resources like fallen palm leaves, they promote sustainable agricultural and forestry practices.
4. **Local Economies:** Their production can provide employment opportunities in local communities.
5. **Biodegradation:** Proper disposal enriches soil with organic matter, benefiting agriculture and landscaping.
6. **Reduced Plastic Dependency:** They help reduce reliance on single-use plastics, mitigating plastic pollution.
7. **Regulatory Compliance:** They align with regulations and bans on single-use plastics in many regions.
8. **Consumer Preference:** Attract environmentally-conscious consumers seeking eco-friendly products.
9. **Event and Catering Industries:** Offer a convenient, eco-friendly option for serving food at events without compromising quality.
10. **Reduced Clean-up Costs:** Simplify post-event clean up by composting biodegradable products [6] [7].

Advantages of using eco-friendly palm plates:

Dining palm plates, often referred to as palm leaf plates or palm leaf tableware, have gained popularity as an eco-friendly and sustainable alternative to traditional disposable plates made from plastic or paper. These plates are typically made from fallen palm leaves and are a great example of sustainable, biodegradable, and environmentally friendly dining options [9]. Let's discuss some key points about dining palm plates in the context of eco-friendliness and sustainability:

1. **Biodegradability:** One of the most significant advantages of palm plates is their biodegradability. Unlike plastic or Styrofoam plates, which can take hundreds of years to decompose, palm plates break down naturally and quickly, returning to the earth without leaving harmful residues [10].

2. **Renewable Resource:** Palm leaves used for making these plates come from the Areca palm tree, which is a fast-growing and renewable resource. Harvesting palm leaves for these plates doesn't require cutting down the trees, as they naturally shed their leaves [11].
3. **Minimal Processing:** The production of palm plates involves minimal processing. The leaves are collected, cleaned, and molded into plates without the need for chemicals or synthetic materials, reducing the environmental impact associated with manufacturing.
4. **No Deforestation:** Unlike some other disposable tableware options, palm plates do not contribute to deforestation. The Areca palm trees are cultivated, and their leaves are collected sustainably without harming the natural environment.
5. **Reduced Carbon Footprint:** The production and transportation of palm plates typically have a lower carbon footprint compared to plastic or paper alternatives. They are often produced locally, reducing the energy and emissions associated with long-distance shipping.
6. **Supporting Local Communities:** The production of palm plates often takes place in rural or economically disadvantaged areas where Areca palm trees are abundant. This industry can provide livelihoods for local communities, supporting sustainable economic development.
7. **Versatility:** Palm plates come in various shapes and sizes, making them suitable for a wide range of dining occasions, from casual picnics to upscale events. Their versatility makes them a practical choice for eco-conscious consumers.
8. **Aesthetics and Functionality:** Palm plates have a rustic and natural look that can add an aesthetic appeal to dining settings. They are also sturdy and heat-resistant, making them suitable for serving hot and cold foods.
9. **Consumer Awareness:** As more consumers become aware of the environmental impact of their choices, there is a growing demand for eco-friendly dining options. Palm plates align with this trend, and their availability in the market reflects the changing preferences of consumers [12].
10. **Challenges and Improvements:** While palm plates offer many benefits, there are still challenges to address, such as the need for standardization in production methods and ensuring fair labour practices in palm plate manufacturing [13].

Final Pronouncement:

As per the data analysis, the palm leaf plates are biodegradable, you can easily throw them away without harming the environment. To decompose the plates, dig a small hole in your background, collect all the plates and bury them. The decomposition process will quickly take place between 70-90 days. If the containers are in good condition, you can easily wash them and use them again. You can use palm leaf plates if we want to protect our environment and keep it safe for our coming generations.

4. Conclusion

In summary, dining palm plates are an eco-friendly and sustainable alternative to traditional disposable tableware options. Their biodegradability, use of renewable resources, minimal processing, and support for local communities make them a compelling choice for those looking to reduce their environmental footprint during dining events and contribute to a more sustainable future.

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