

THE BANANA LEAF PROJECT

Radha Shah
Bio and Nano Technology + Design
Victoria Vesna
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**WHAT IS
WRONG WITH
THE CURRENT
METHODS OF
PACKAGING?**

HUMAN HEALTH AND SAFETY

Sustainable packaging minimizes exposure to potentially toxic and hazardous chemicals. Certain known toxicants are used legally in food contact materials (FCMs). Plastic bottles used for carbonated drinks, for example, usually contain low levels of formaldehyde, a toxin known to cause cancer.

STYROFOAM

Skin and eye irritation, respiratory ailments, headache, fatigue, depression and kidney failure (1).

Polyethylene terephthalate (PET), a plastic used to store beverages, contains antimony, a toxic metalloid. Antimony exposure can lead to nausea, diarrhea and stomach ulcers (1).

BPA

Since BPA (Bisphenol A) is used in so many different products, the accumulation of this chemical following chronic low-dose ingestion has been associated with a wide variety of toxic health effects, most predominantly endocrine disruption by reducing testosterone secretions (2).

Additional effects of BPA exposure include diabetes, obesity, cardiovascular diseases, chronic respiratory diseases, kidney diseases, breast cancer, behavioral issues, tooth development defects, and reproductive disorders in both men and women (2).

PHTHALATES

The three major types of phthalates are typically added to plastic resins in an effort to increase the flexibility of final products. Since the bonds between the phthalate chemicals and their parent materials are non-covalent in nature, it is easy for these potentially harmful chemicals to leach from plastic products and be ingested, to ultimately cause adverse health effects (3).

As an endocrine disruptor, some of the most concerning health effects of phthalate ingestion include:

- Decreased semen quality in men

- Increased risk of endometriosis in women

- Increase in the body mass index (BMI) in men and women

- Altered infant hormone levels and altered child neurobehavioral outcomes for pregnant women (3).

RESOURCE CONVERSION

Sustainable packaging maximizes the use of recycled materials and low-impact production processes, thereby conserving raw materials. Conserving raw materials, in turn, preserves natural resources for future generations.

The use of sustainable packaging can also play a role in the amount of energy it takes to package a product or make the actual packaging itself. It can reduce solid waste, water usage, electricity and emissions (4).

Though there is a negative view on flexible plastic packaging by those who are not fully aware of packaging product lifecycles, plastics have the upper hand on reducing carbon footprint.

A study done by Franklin Associates, A Division of Eastern Research Group (ERG) back in 2014 for the American Chemistry Council (ACC) and the Canadian Plastics Industry Association (CPIA) (4) shows the following:

For 6 plastic packaging categories analyzed including caps and closures, beverage containers, shrink film and stretch film, carrier bags, other flexible packaging and other rigid packaging options:

Plastic packaging enables weight savings of over 78% when compared to alternative packaging materials

In 2010, 14.4 million metric tonnes of plastic packaging were used. If alternative packaging were substituted, more than 64 metric tonnes of material would be required.

The substitute packaging would require more than 80 percent more cumulative energy demand and 130 percent more global warming impact. This would be equivalent to adding more than 15.7 million vehicles to our roadways (4).

The Earth forms natural resources very slowly and it takes a very long time. The resources that are easiest to dig out are used up first. This includes the minerals in high concentrations and those that are near the surface. Once these are used up, it is necessary to look for more. These resources are harder to obtain and in lower concentration. This makes them more expensive to obtain so goods cost more.

PLASTIC PRODUCTION

Plastics are produced from natural gas, feedstocks derived from natural gas processing, and feedstocks derived from crude oil refining. Petrochemical feedstock naphtha and other oils refined from crude oil are used as feedstocks for petrochemical crackers that produce the basic building blocks for making plastics. The petrochemical industry also consumes large quantities of hydrocarbon gas liquids (HGL), which may be produced by petroleum refineries or natural gas processing plants (5).

In 2017, 86% of the HGL produced in the United States were byproducts of natural gas processing, and the remaining 14% were from crude oil refineries (5).

EXPANDED POLYSTYRENE (STYROFOAM)

The manufacturing process is energy intensive and heavily reliant on petroleum, a finite resource. A single cubic foot of expanded polystyrene, for example, contains the energy of about 1.5 liters of petroleum. This rapid use and disposal of petroleum brings up additional concerns about national security and the increasing financial and political costs of purchasing petroleum from an unstable outside sources. Toxic Release Inventory reports from 1992 show that 32.8 million pounds of styrene were released into the natural environment that year, with the majority being released to the atmosphere and smaller amounts being released to land and waterways (6).

ENVIRONMENTAL IMPACT

Conventional packaging materials can be resource-intensive and wasteful. For example, producing a single cubic foot of Styrofoam requires about 1.5 liters of petroleum . This is the same amount a 20-mpg car needs to travel 8 miles.

REDUCING OUR CARBON FOOTPRINT

Carbon footprint is defined as the amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person, group, etc. We would inevitably be reducing our CO₂ emissions by cutting down on the amount of packaging for goods (7).

The weight of packaging materials will directly impact the amount of energy required to produce finished goods and the energy required to ship them to the retailer or end-user. Switching to a lighter weight material can positively impact our carbon footprint (7).

LANDFILLS

In 2001, it is estimated that approximately 9.3 million tonnes of packaging waste was generated in the United Kingdom alone. Such waste almost always ends up in landfills. Much of the waste found in landfills is packaging waste. Much of this packaging, including polystyrene and other plastics, does not break down quickly. In fact, some of the packaging making its way to landfills does not break down at all, creating long-term environmental problems (8).

LIFETIME OF RECYCLABLE MATERIALS

Let's break down the lifespan of some of the most commonly used packaging materials (9):

Paper — 5 to 7 times

Cardboard — 3 to 4 times

Plastic — Once

Polystyrene — Once

EXAMPLES OF SUSTAINABLE PACKAGING

OOHO! EDIBLE WATER BUBBLE

ooho! is a bubble designed by skipping rocks lab that encircles drinking water within an edible membrane made from a natural seaweed extract. if you don't feel like eating it, the flexible, bubble-like packaging biodegrades in just 4-6 weeks, the same time as a piece of fruit. the membrane can be flavored and colored, and can also be used for other liquids such as soft drinks, spirits and cosmetics (10).

SALTWATER BREWERY

Saltwater Brewery in Delray Beach, Florida, recently released edible six-pack rings, a brand-new approach to sustainable beer packaging. These six-pack rings are 100 percent biodegradable and edible—constructed of barley and wheat ribbons from the brewing process (11).

BAKEYS EDIBLE CUTLERY

Knowing the threat plastic poses to our environment and health, Narayana Peesapathy created a tasty and nutritious alternative: edible cutlery. Made with flours of jowar (sorghum) blended with rice and wheat, the spoons contain no chemicals, preservatives, fat, emulsifiers, artificial colors, or milk products. They're 100 percent natural, biodegradable, and come in a variety of sweet and savory flavors (12).

OTHER ALTERNATIVES

Mushroom root

With Mycelium (mushroom roots, funnily enough, the same stuff that Quorn is made from), packaging is literally grown. Ecovative Design gather agricultural waste, mix it with the mycelium in moulds and then the packaging quite literally grows. You can see how it works here, though I'm not 100% sure it isn't magic (13).

Bagasse

Bagasse is a by-product of sugarcane processing. Due to its malleability and stickiness, it can be easily moulded into packaging suitable for food delivery and food service – similar to polystyrene. Unlike polystyrene, it's certified biodegradable and compostable, and being a by-product, much more sustainable to produce (13).

Corn starch and sorghum loose fill

EcoFlo loose fill is made from corn starch and can be used the same way as regular polystyrene loose fill. This eco version – which can also be made from sorghum (a crop similar to popcorn) – is biodegradable, odour free, and maybe best of all; static-free (13)!

Plant-based plastics

Bioplastics are made from a variety of sources such as corn, which is broken down into PLA, or polylactic acid. This is incredibly sustainable to produce, as it's made from the waste products from the production of corn – which is also easy to grow. PLA can be used to make drinks bottles, various food grade containers, as well as films. Eco-heroes Innocent are now making their bottles from 15% PLA (13).

Palm leaves

Holy Lama use palm leaves from the areca palm to create the oyster-like cases for their handmade soaps. The leaves fall naturally from the areca palm, then they are collected and moulded into the desired shape. Brilliantly environmentally friendly as they use a natural waste product of the areca palm and the final packaging product is biodegradable (13).

BENEFITS OF NATURAL PACKAGING MATERIAL

THE BETEL LEAF

Help treat diabetes: Components present in betel leaves can reduce the level of sugar in the blood
Aids in weight-loss: Reduces body fat by increasing the metabolic rate of the body.

Prevents carcinogens that lead to cancer: Prevent oral cancer as it helps maintain the levels of ascorbic acid in the saliva.

Heals wounds: Betel leaves, when applied over a wound and bandaged, can accelerate the healing process. They are also widely used in Ayurveda for treating boils.

Cures headaches: The leaves have cooling properties which provide instant relief from the ache when applied externally (14).

THE BANANA LEAF

The chlorophyll in the leaves prevents intestinal ulcer and skin disease.

Cleanses the blood.

Stimulates appetite and helps digest food.

Benefit your skin health.

Soothes the mucous lining in the stomach and cures ulcer.

Good remedy for kidney stones and other bladder related diseases.

Boosts Immune system (15).

PANDAN

Pain Reliever: Pandan leaves contains laxative properties that can act as a pain reliever from headache, ear pain, chest pain, and arthritis.

Overcoming Weak Nerves: Pandan leaves helps to promote health and nerve system in our bodies.

Relieving Insomnia: Pandan leaves contain alkaloid compounds that can provide a calming effect

Cope with Diabetes: One of the treatment of diabetes is replacing sugar or sweetener with pandan leaves (16).

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BANANA LEAF USED PRACTICALLY FOR FOOD STORAGE

Cooking

Take Banana Leaves and cut them to the right size, then to make them easier to fold pour hot water over them for a few moments so they will get soft. Then you can fold them up and with your food inside and tie them up with a cotton string. Then place them in a pot for cooking or even put them right on the grill. Or Banana Leaves can be made into little tents tied at the top with string or tooth picks to hold them together for steaming food.

Freezing

Banana Leaves keep well for later use, just cut them up and freeze them and they will keep for long periods of time, especially if you put them in seal-a-meal packages and remove the air. You could pour hot water on them before freezing if you want make them easier to fold.

Banana Leaves make great plates, can be used instead of foil, parchment, and waxed paper. They are very flexible, large, and waterproof, and in some countries they are even used as wrappers for frying foods, leaves and all are fried.

Disposal

Banana Leaves are great as plates for food, they grow fast, are sturdy, very clean, large, and break down and add nutrients to the soil, and they make a very hearty compost for your garden.





WHY EAT ON A BANANA LEAF?

1. Imparts Great Flavour

Banana leaves have a waxy coating on them which has a subtle but distinct flavour. When hot food is placed on the leaves, the wax melts and lends its flavour to the food, making it taste better. Steaming or cooking food in banana leaf also adds a sweet flavor and imparts astringency to the food.

2. Environment Friendly

People use plastic and Styrofoam plates as disposable plates which cause great harm to our environment and the animals. Banana leaves are eco-friendly and can be eaten by other herbivorous animals.

3. Clean And Hygienic

Banana leaves do not require a lot of cleaning – they just need to be rinsed with a little water and they are ready to use. If you are eating at a place where the hygiene standards are questionable, you are much better off eating from a banana leaf than from a plate that has not been cleaned properly.

4. Chemical-Free

Even with a dishwasher, if you are using chemical soaps and detergents which are environmentally damaging, they can affect you too. These traces of toxic chemicals may still remain on your plate and cause havoc. Banana leaves carry no such harm.

5. Waterproof

Because of their waxy coating, banana leaves can be used to serve gravy, curries, and slightly soupy preparations without turning soggy. They are also a great alternative to aluminum foil and can be used to pack lunches for picnics (17)

1. Adec Group - Web Development Team. Judging by the Cover: The Importance of Sustainable Packaging, www.firstcarbonsolutions.com/resources/newsletters/november-2015-judging-by-the-cover-the-importance-of-sustainable-packaging/judging-by-the-cover-the-importance-of-sustainable-packaging/.

2. Eladak, S., Grisin, T., Moison, D., Guerquin, J., N'Thumba-Byn, T., Pozzi-Gaudin, S., et al. (2015). A new chapter in the bisphenol A story: bisphenol S and bisphenol F are not safe alternatives to this compound. *Fertility and Sterility* 103(1), 11-21. DOI: 10.1016/j.fertnstert.2014.11.005.

3. Liao, C., Liu, F., & Kannan, K. (2013). Occurrence of and Dietary Exposure to Parabens in Foodstuffs from the United States. *Environmental Science & Technology* 47, 3918-3925. DOI: 10.1021/es400724s.

4. Roberge, David. "6 Benefits Of Sustainable Packaging." Flexible Packaging Products & Services and Supply Chain Services, 12 Apr. 2018, www.industrialpackaging.com/blog/6-benefits-of-sustainable-packaging.

5. "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." How Much Oil Is Used to Make Plastic? - FAQ - U.S. Energy Information Administration (EIA), www.eia.gov/tools/faqs/faq.php?id=34&t=6.

6. Fish, Emily. "Expanded Polystyrene and a 100% Compostable Alternative" *City of Fort Collins*. July 17, 2013. <https://www.fcgov.com/climatewise/pdf/expandedpolystyrene.pdf>

7. Roberge, David, and David Roberge. "6 Benefits Of Sustainable Packaging." Flexible Packaging Products & Services and Supply Chain Services, 12 Apr. 2018, www.industrialpackaging.com/blog/6-benefits-of-sustainable-packaging.

8. Flaherty, Stewart. "What Are the Environmental Impacts of Product Packaging?" Bizfluent, 11 Feb. 2019, bizfluent.com/info-8215836-environmental-impacts-product-packaging.html.

9. "How Does Packaging Affect the Environment?" Charlotte Packaging Lt, 27 June 2016, www.charlottepackaging.com/latest-news/packaging-affect-environment/.

10. "The Ooho! Edible Water Bubble Gets Set to Replace Plastic Bottles." Designboom, 23 Oct. 2018, www.designboom.com/technology/skip-ping-rocks-lab-ooho-edible-water-bottle-04-12-2017/.
11. Galanty, Heather. "Saltwater Brewery Creates Edible Six-Pack Rings." CraftBeer.com, 13 Apr. 2018, www.craftbeer.com/editors-picks/saltwater-brewery-creates-edible-six-pack-rings.
12. "A Spoon You Can Eat Is a Tasty Alternative to Plastic Waste | Short Film Showcase." National Geographic, www.youtube.com/watch?time_continue=3&v=r4Cc5zmy0eY.
13. Greenway, Shelly. "13 Plastic Packaging Alternatives." Innovation Excellence, www.innovationexcellence.com/blog/2018/07/02/13-plastic-packaging-alternatives/.
14. Bhalla, Nikita. "5 Health Benefits of Chewing Paan or Betel Leaves Nobody Told You About." India Today, 11 Apr. 2016, www.indiatoday.in/lifestyle/story/5-health-reasons-nobody-told-you-about-chewing-paan-or-betel-leaves-tobacco-areca-nuts-317369-2016-04-11.
15. Chandraan, Rachele. "Eat On A Banana Leaf For Healthier Immune System." CureJoy, 12 July 2017, www.curejoy.com/content/eat-on-banana-leaf-immune-system/.
16. "19 Health Benefits of Pandan Leaves That You Might Not Aware." The, 23 Oct. 2017, the-benefits.com/pandan-leaves/.
17. Chandraan, Rachele. "Eat On A Banana Leaf For Healthier Immune System." CureJoy, 12 July 2017, www.curejoy.com/content/eat-on-banana-leaf-immune-system/.