

ZICO(PET and Tetrapak) Package Comparison for Sustainability Improvement

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ABSTRACT : The choice of one or the other package can be an economic decision or can be affected by cultural factors. Acceptance of human convenience or understanding of it. Food packaging systems may be configured for one-time use or for multiple uses. Package perceptions typically develop from a given country. Variety of factors including climate, lifestyle and cultural acceptance of specific products. It's important in an increasingly global economy with multinational companies marketing products worldwide to grasp the gaps between customer needs and market responses. Systems. They defined trends and patterns between countries using descriptive statistics. Results stated a Relationship between individualistic and collectivistic ideology, country status as well as created or built in support of customer expectations of packaging items. Often appears. To be a relationship between dominant attitudes and perceptions of environmental sustainability of the packaging on the product. This work is hoped to be useful for companies that export or are trying to export the goods to other markets.

KEYWORDS: Tetra Pak ®, product packaging method, understanding, package design, customer behaviour, Sustainable, secondary use.

I. INTRODUCTION

As the Hawaiians say, coconut water is "dew from the heavens".

Coconut has been seen as a great source of versatility for many years. Coconut is being used as food, drink and some forms are used for clothing and shelter. Coconut is one among the very few products which available all year round. Recognising its value, many countries have concentrated on its production and exporting it.

Coconut water is sterilized by heat treatment to increase the shelf life of it before packaging. Sterilization helps to eradicate the micro-organisms. This sterilized liquid comes in 2 types of packaging- Tetrapak and PET bottle.

Objective

The objective of this project is to compare two packaging types of the brand Zico and evaluate its merits and demerits, analyse the packaging system, and conduct a study to analyse the life cycle assessment of the packaging system to determine the environmental impact of it and to modify the worst packaging system of both to make it better in-terms of sustainability.

Company background:

Zico was founded by Mark Rampolla in the year 2004 ("ZICO (beverage)", 2018). Initially the coconut water was sold on central America after he realised the demand for coconut water by the locals. The company gets the coconut water from the farmers of Thailand, Indonesia and the Philippines. Thailand is one of their primary source, Zico coconut water is being packaging in Thailand and it is shipped to Texas. The product is then distributed all over the united states. In the year 2013, Coca – cola purchased better part of Zico share.

Market share: Coconut water market size in the United States from 2014 to 2019 (in million U.S. dollars) *

Supply chain process:

Zico supply chain

Packaging Materials Used For Zico Coconut Water:

Zico coconut water is now available in two types of packaging system.

- Tetra pack
- Pet bottle

Tetra pack: It is recyclable; it is made up of paperboard, polyethylene, and aluminium foil ("Packaging material for Tetra Pak carton packages", n.d.). The closure of the tetra pack is made of up polypropylene. Tetra pack is the organisation which supplies this package for Zico.



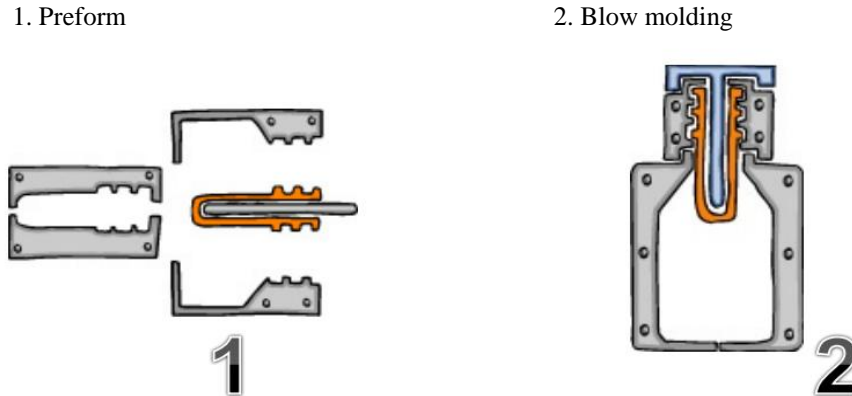
II.MANUFACTURING PROCESS OF TETRA PACK

TetraPak cartons are most commonly used aseptic cartons, which are capable of protecting and preserving liquid food items without any major refrigeration. TetraPak is a multilayer packaging material consisting different materials, serving different requirements. This type of containment blocks and protects the product from light and preserves vitamins in it. Tetra Pak's are typically made up of 6 layers. It is made up of Paperboard, Aluminium and Polyethylene, which are laminated to each other with some special treatments. All these raw materials are imported to the manufacturing plant. The paper is produced using wood chips and some special additives. This paper part is recyclable and can be used to produce other paper and tissue products after proper recycling. Firstly the paperboard is printed with Flexography printing process and laminated with polyethylene inline on the press itself. Then this laminated paper is fume treated to adhere aluminium and polyethylene to it. Then this material is finally laminated with food grade polyethylene and also having good sealing properties. After this, all the layers are pressed against a roller to form a multilayer roll. This roll is then formed into carton, sealed from sides and equipped with spout and produced as TetraPak.

Pet bottle: It's a usual PET bottle with a shrink label covered over it. Its closure is made up of polypropylene.

III.MANUFACTURING PROCESS OF PET

One of the Zico coconut water bottle is made of Polyethylene Terephthalate and closure is manufactured from Polypropylene. Primary container is produced with the help injection molding process. Injection molding is a two-step process in which preform is first produced by injection molding. In second step, bottle is manufactured by blowing pre-form with a blow molding process. The process of making Zico coconut water bottle is depicted below:



Recycling and disposing

Tetra pack: Tetra pack organisation claims that recycling is part of their environmental agenda and their goal by 2010 is to double their recycle percentage to 40 by 2020. Since then they have achieved an increase in the recycling percentage annually from 25% to 35% so far. Usage of tetra pack also increased from 32 billion in 2010 to 47 billion in 2016. Tetra pack is made up of layers like paper, polymers and aluminium. All of these can be converted into new products after cutting certain amount out and sent for landfill. Tetra pack divides the recycling into three categories depending upon the material.

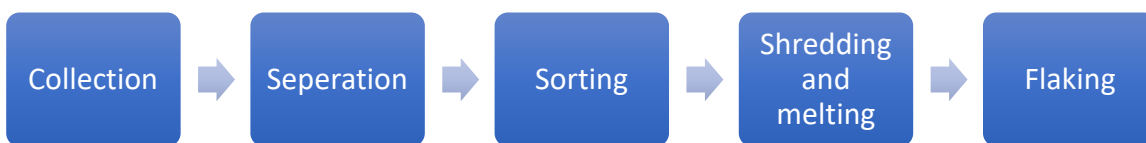
Fibre recycling – The paper present in the tetra pack package is used to produce pulp for new paper.

PolyAl recycling – The polyethylene (polymer) and the aluminium are used either individually or separated, recycled and used as a material for their new products.

Full carton recycling– In this process, the whole package is used to produce new products without segregating any of its layers.

PET bottle:

A systematic flow chart of the process involved in the pet bottle recycling.



Empty PET bottles are collected and taken to the recycling facility for sorting. Then the PET bottle is crushed, pressed to bales. Light blue and color less PET bottles have more value than dark blue color PET bottles. Then the PET bottles are further Shredded into smaller fragments, it may still contain small amount of residue such as labels, they are further treated and pure PET flakes are formed. Melt filter is generally used to remove the contamination during extrusion. As PET is sensitive to hydrolytic degradation, it should be dried to <100 parts per million moistures and maintained at this level on the melting process. Dehumidifying dryers are used to circulate hot and de-humidified air("PET bottle recycling", 2018).



Bill of material

Zico coconut water - Tetra pack		
Part	Material	Mass (lb)
Bottle	LDPE	0.006
	Paper	0.08
	Aluminium	0.01
Closure	Polypropylene	0.0034
Pallet	Wood	6.94
Stretch wrap	LLDPE	0.42
Total		7.4594

**Values for pallet and stretch wrap are taken under assumption*

Zico coconut water - PET bottle		
Part	Material	Mass (lb)
Bottle	PET	0.071
Closure	Polypropylene	0.033
Shrink label	PETG	0.0055
Pallet	Wood	6.94
Stretch wrap	LLDPE	0.42
Total		7.4695

**Values for pallet and stretch wrap are taken under assumption*

CES

CES is software that provides a wide-ranging database of different materials, their properties, processes and information about end of life options. The software is often used as a dictionary of materials for gathering data. In addition, software can also be used as a strong tool to compare materials and their impacts on environment.

In our project, we are using the software to analyse the impacts of materials properties, manufacturing and transportation on the environment and to compare two given materials: PET bottle and Tetra Pak.

Single Item

The comparison is done for single product of each PET bottle and Tetra Pak. Upon entering inputs, software tells us about the cost, Co₂foot print and energy required for material, manufacturing, transport, use and disposal. Individual data about PET and Tetra Pak is first obtained and then products are compared as shown below.



PET Bottle – Inputs:

Dimensions: 2.604x2.604x8.500 in

Components and material:

Bottle: PET

Closure: PP

Label: PETG

Coconut Water: Bamboo (Assumed as material)

Transport:

In a seatainer, bottles are transported for about 9095 miles from manufacturing facility in Thailand to a port of Houston located in Texas.

Bottles are further sent to distribution centres in Dallas, 239.1 miles away from the port in a 32 tonne truck.

From above mentioned inputs, summary charts and detailed reports are obtained about impacts of PET bottle on the environment. Derived charts and report are shown below.

Tetra Pak – Inputs:

Dimensions: 3.084x2.856x8.652 in.

Components:

6 Layer structure made up of LDPE, Paper, Aluminium foil and LLDPE

Closure: PP

Coconut Water: Bamboo (assumed as the product inside.)

Transport:

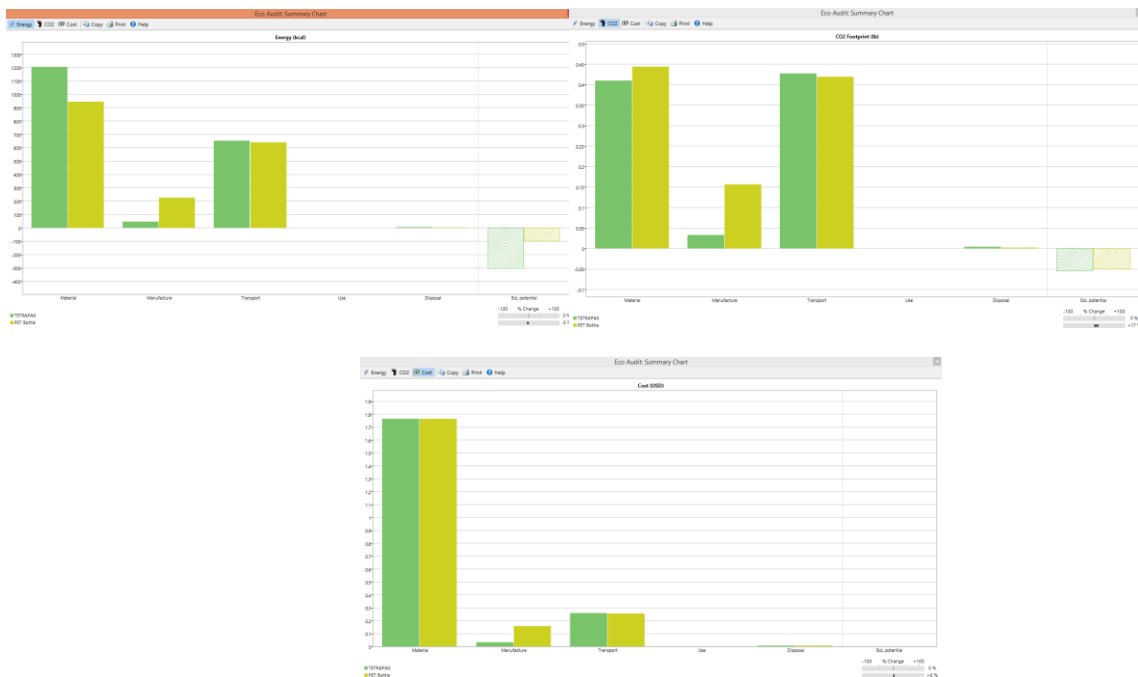
In a seatainer, Tetra Pak’s are transported for about 9095 miles from manufacturing facility in Thailand to a port of Houston located in Texas.

Tetra Pak’s are further sent to distribution centres in Dallas, 239.1 miles away from the port in a 32-tonne truck.

From above mentioned inputs, summary charts and detailed reports are obtained about impacts of Tetra Pak on the environment. Derived charts and report are shown below.

Single Package Comparison

From the above information, comparison between PET bottle and Tetra Pak in terms of energy, co2 and cost requirement is done. Summary Charts of the comparison are shown below.



It can be concluded from the above charts that for materials and transport category, energy required for Tetra Pak is more than PET bottle and for manufacturing, energy required to produce PET bottle is more than Tetra Pak. CO₂ emitted during manufacturing and material production is more for PET bottle than Tetra Pak whereas Tetra Pak

requires more CO₂ emission during transportation than PET bottle. Cost required for all categories is almost same for both types of packages except for manufacturing. Manufacturing PET bottle is more expensive than Tetra Pak.

IV. CONCLUSION & DISCUSSION

It can be concluded from the above report and charts that PET bottle is worse package than Tetra Pak in terms of sustainability. Following are the improvements attempts made to improve the PET bottle performance and make it as good as Tetra Pak:

1) Change in Manufacturing Process

Current PET bottle is made from injection blow molding which requires lot of energy to manufacture the PET bottle. Impacts of PET bottle manufacturing on environment can be reduced by changing manufacturing process to extrusion blow molding. Extrusion blow molding requires less energy in production process than Injection blow molding.

2) Reduction in Bottle Weight

Weight of the PET bottle and closure is reduced by 0.02lb and 0.01lb respectively. This will allow significant change in energy required for material and manufacturing. In addition, CO₂ emission and cost required will also change due to this improvement.

3) Change in labelling technique

Current PET bottle has shrink label made up of PETG. This could create problems in recycling PET bottle as recycling requires separation of labels from bottles before recycling. This is time consuming and expensive. Thus we change decorating type from shrink label to pressure sensitive label. This would improve end of life process for the PET bottle.

4) Change in PET bottle size to accommodate more CMUM

PET bottle size is increased to contain 1 Liter of coconut water. This will reduce the amount of energy required to manufacture, transport and for raw materials.

REFERENCES

1. Packaging of Coconut Liquid Products. (2017, February 25). Retrieved April 15, 2018, from <http://coconuthandbook.tetrapak.com/chapter/packaging-coconut-liquid-products>
2. PET Bottle Being Recycled Infographic | A great visual description. (2015, January 22). Retrieved April 15, 2018, from <http://ripplefxwater.com/pet-bottle-being-recycled/>
3. PET bottle recycling. (2018, April 11). Retrieved April 15, 2018, from https://en.wikipedia.org/wiki/PET_bottle_recycling
4. Why Tetra Pak's aren't Green (even though they're recyclable). (2017, March 11). Retrieved April 15, 2018, from <https://treadingmyownpath.com/2014/09/11/why-tetra-paks-arent-green-even-though-theyre-recyclable/>
5. Zico. (n.d.). Retrieved April 15, 2018, from <http://zico.com/faqs/>
6. ZICO (beverage). (2018, April 10). Retrieved April 15, 2018, from [https://en.wikipedia.org/wiki/ZICO_\(beverage\)](https://en.wikipedia.org/wiki/ZICO_(beverage))
7. Packaging material for Tetra Pak carton packages. (n.d.). Retrieved April 15, 2018, from <https://www.tetrapak.com/packaging/materials>
8. Carton recycling. (n.d.). Retrieved April 15, 2018, from <https://www.tetrapak.com/us/sustainability/carton-recycling>
9. Our goal to double the recycling rate. (n.d.). Retrieved April 15, 2018, from <https://www.tetrapak.com/sustainability/recycling>
10. <https://www.artlebedev.com/tetrapak/site/process/>