

Plastics Use and Sustainable Development of Food and Beverage Packaging

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Abstract

In recent years, promoting and producing products in a more sustainable way has become a key concern to governments, businesses and the public. The production of packaging is a huge industry and can have an enormous negative effect on the world's environment when we consider its size and the fact that it is an integral part of our life (Ebrocolor, 2016). This project focuses on how to reduce packaging waste as well as reduce unnecessary using with the aim of achieving green packaging. Thus, some secondary research collected from the internet and books are used in this paper. The findings are oriented towards two strategies which are helpful to reduce the first strategy is to promote the durability of packaging by using ecological materials in regard with cellulose Nano-fibres. Increasing the rate of packaging recycling is the second strategy. Waste does not need to be considered as rubbish but something that can be recycled and reused to make new products.

Keywords

Plastics; Sustainable development; Packing; Logistics.

1. Introduction

Several studies investigating green packaging can be found in journals, books and on the internet. They work for the research question of this project: How can we reduce packaging waste and develop sustainable packaging? Two strategies for solving this issue are concluded to promote the durability of packaging; recycle and reuse more efficiently. Generally, reduce, reuse, recycle and recover packaging are proportional to the cost saving in materials, energy, transport and disposal (Unilever, 2017). In addition, two companies from China and UK, CAINIAO and Unilever, will be discussed in the aspect of what are the differences of policies when they face the problem of packaging waste in the results and discussion section.

2. Literature Review

2.1. Sustainable Packaging Features

Minimizing the ecological footprint and environmental impact of packaging is the aim of sustainable packaging (Khalil et al., 2016). According to the research by Khalil et al. (2016), an industry working group-Sustainable Packaging Coalition (SPC) defined green packaging in brief sentences as the conditions of sustainability.

- (1) To be beneficial, safety and healthy for individuals and communities throughout its lifecycle;
- (2) To meet market criteria for both performance and cost;
- (3) It is available to be sourced, manufactured, transported, and recycled;
- (4) To consider maximizing the use of renewable or recycled resource and materials;
- (5) Is manufactured using clean production technologies and best practices;
- (6) Is made from non-toxic materials in all probable end-of-life scenarios;
- (7) Is physically designed to optimize resource;

(8) Is effectively recovered and reused in biological and/or industrial 'cradle-to-cradle' cycles.'

2.2. Plastic use: Pros and Cons

Plastic is one of the most remarkable material innovations of 20th century but it is a huge spectrum of uses poses a major problem to the way in which it is disposed of. A number of different options are available in dealing with plastic waste, and few can be considered close to sustainable. Incineration, a typical example in this case, it does provide us with a source of energy. Even though some plastics have a greater energy per weight ratio than coal, the by-product are created in incineration process with highly toxic and need filtering to prevent gases and heavy metals reaching the biosphere and other ecosystems (Denison & Ren, 2001; Radhakrishnan, 2016).

Plastics use in packaging industries have been seemed as fairly bristles with controversy.

Several reports use the data to argue that plastics are versatile, they offer high strength, low weight and a wide range of vivid colours are relatively affordable (Denison & Ren, 2001; Inns, 2009; Davis, 2011; Lewis et al, 2010; Lewis, Verghese & Fitzpatrick, 2010; Thompson & Hudson, 2013; Gonzalez-Garcia et al., 2016).

Thompson and Hudson (2013) found out, recently popular plastic materials could be separated by two categories, one of them is made from petrochemicals which are derived from crude oil and available to be recycled at the end of their life, or the energy they contain can be recovered by incineration (Thompson, 2013). Synthetic plastics may also use bio-based building blocks which is made up of such as wheat rice and corn (Denison & Ren, 2001; Thompson, 2013). In accordance with recent studies, plastics packaging use over recent decade arrive at a high level in availability, durability, recyclability but low biodegradability with medium to high consumption of energy and pollution (Denison & Ren, 2001; Thompson, 2013; Radhakrishnan, 2016; Gonzalez-Garcia et al., 2016). To break the chosen field down further the table below was concluded from the empirical findings of Thames and Hudson (2013).

2.3. Essential Information Panels

Table 1. Plastics use

Materials Key features	Plastics	Bio-based plastics	Cellulose Acetate (CA)	Natural rubber	Glass	Pulp, paper and board
Availability	5	3	4	4	6	5
Durability	5	5	4	6	6	6
Recyclability	5	1	7	1	7	7
Biodegradability	1	6	7	1	0	7
Energy	5	3	5	3	3	3
Resources	3	3	3	2	3	3
Pollution	4	3	3	3	3	3
Waste	3	2	3	3	2	2
Alternative and competing materials	Glass, paper and board	Plastic and Glass	Plastic	Bio-plastic, Plastic and CA	Plastic	Plastic

The table above provide a rough guide to the essential features of each process to help inform designers and aid decision-making. Comparable values in the table is relative, 7 is the highest level, therefore, the most applicable and sustainable processes will have great number of 4 sections on the top and fewer dots in the next 4 sections related to environmental impacts. Except plastic materials, other four materials are popularly used in similar areas. through the

comparison between plastic materials and others in the point of view that to what extent they affect each process on people and environment

Plastic materials are set into a medium level in essential information panel that determine the impacts of each process on people, such as extracting materials, making products and recycling. Certain plastics might also be bio-based, but these products are not always superior to conventional plastics if factors such as land and water use are considered (Thompson & Hudson, 2013). In addition, biodegradable plastics from some classes of products may not be bio-based (Thompson & Hudson, 2013). Thames and Hudson (2013) stress the environmental benefits of biodegradable plastics depends on the application. Using one of the example from the guide book by same person, these plastics are used as an efficient way to contain and dispose of organic matter into municipal composting waste streams (Thompson & Hudson, 2013). This method reduces the amount of solid waste going to landfill, which is major environmental benefits. Special sorting systems can be used to ensure that if biodegradable plastics pollute the recycling streams of other plastics.

Predominantly alternative and competing materials for plastic packaging used by F&B companies include glass, paper and board. Glass and paper are both regarded as the best alternatives. Glass has a greater function in using and product protection without biodegradability but keeps high recycle rate and low waste, which seems as the reasons why it is used widely in many beverage industries for a long time. However, the limitation of non-degradable waste probably becomes an important factor when people weed out it in the future. Although, plastic has more environment effects than the others, it still being used in a boarder field as a substitute product today.

The value of packaging is often seemed as a paradox. Kirsi and Tenkanen (2012) acknowledged an undeniable fact that petroleum-based synthetic plastics have many convenient and extensive use attributions, as a result they are variously used as food packaging. Nerveless, then they explicitly indicated a significant drawback of plastic as an essential evidence of refutation that plastic permanently surround us after use (Kirsi and Tenkanen, 2012).

What encouraged researchers to look for a straight substitution considered in bio-based of petrochemicals (such as hemicelluloses) could be the depletion of petroleum deposits together with accumulations of plastic waste in the environment, and were specific to landfill (Kirsi and Tenkanen, 2012). It did not mean hemicelluloses are necessarily superior, those ingredients are plentiful in the nature with potential low-cost by-products recovered in large quantities from side-streams of the agriculture and forestry industry but compared with the commercial value of cellulose and starch, their commercial utilization was inappreciable. In this case, Kirsi and Tenkanen (2012) suggested new materials Xylans and Mannans could be utilized in new packaging industries.

3. Plastic Packaging Development and Trends

3.1. Product Innovation in Material Reselection

Using non-biodegradable and non-renewable materials for packaging has resulted in a shocking pollution sustainably (Khalil et al., 2016). Thus, environmentally friendly materials are urgently needed that many people hope to satisfy. There are two popular alternative materials of plastic has been a long time for many experts to study deeply with great results of their research will be discussed.

One example is Nano-cellulosic fibres where the raw natural resources have been utilized for more than 150 years in the production of paper, medical and pharmaceutical products, and textiles. One of its uses was to increase the durability of packaging (p.824). Nano-cellulosic fibres was available, most of the time, they were not expensive. Moreover, this material satisfies the four elements of sustainable packaging namely, effectivity, efficiency, cleanliness and

recoverability (p.831). After several years of research dedicated to this kind of fibre, there were some applications raised, the packaging of food and beverages and some potential uses. But these fibres are also limited with regard to packaging applications (empirical, valid, essential characteristics). Therefore, the other point which needed to be considered was the necessary conditions of packaging industries and the collection of relevant information on existing materials of Nano-cellulosic fibres (p.832 - 833).

Xylans and Mannans:

Kirsi and Tenkanen (2012) perceived Xylans and Mannans are “Greenness” materials which created from side-streams of the agriculture and forestry industry easily. Different to Nano-cellulosic fibres, these two new materials are not used widely in F&B product chain now. They still existing in a wide range of packaging use but most of the experts consider the use of Xylans and Mannans in food industries as an assumption in academia.

3.2. Plastic Foot-print: Chances and Challenges

Product safety problem: A warning from UK government not to use polycarbonate in baby bottles was published in March 2011 (Davis, 2011). It became a worry for some people as a safety problem of plastic use.

Plastics in waste: The UK Plastics 2020 Challenge recorded moving plastics

from landfill by 2020 and increasing packaging recycling 50% (GOV.UK, 2018). In 2011, plastics bottle recycling has been found at 46% of total and EPS packaging recycling has reached 30% (Davis, 2011). Mixed plastics still being a challenge in recycling system, Davis (2011) believed that if the unrecyclable plastic can be shifted from waste to energy, it could satisfy 11% of UK Energy needs. Thus, it could be added into future exploitation in eco recycling redesign as an evidence.

Plastics in Marine Litter: The statistics of 10 MPD (Marine Plastic Debris) items removed from global waterways during nearly 10 years before 2015 showed the plastic waste being reduced from 81.5% occupancy in 2006 to 53% in 2015, and food and beverage plastic (such as bottle, food wrappers and bottle caps) decreased 23% in total (Niaounakis, 2017). Although the data above might not satisfy the environmental groups, the number decreases as an improvement in marine environment.

Plastics and Carbon: Plastic consume only 4% of petroleum globally, this is supported by British Plastic federation previously (Davis, 2011). Plastic production was not energy intensive, it saved huge carbon dioxide and conserved energy through the current technology, such as light-weighting and plastics insulation design. In addition, Davis (2012) treated the events of plastic water mains in London preventing 30% leakage, and plastic use as a key material for windmill rotor blades, electric cars and solar panels as the positive futures of plastic use.

4. Conclusion

Packaging has a wide range of functions surrounding the products and produce we want and we need with included safe transportation, portioning and preservation. It provides a platform for information about weight, content and nature of the products as well, which we aim to fulfil various needs centred on product protection. Previous writers keep different views in plastic packaging, the future of it: “Cradle to Grave or Cradle to cradle”. All these people have a clear definition of plastic, good plastic and bad plastic, which represents non-degradable material and environmentally friendly material respectively. Plastics packaging development and trends show what could companies consider when develop new product.

Increasing needs of low-carbon particularly ever-growing demand for green products become a growing trend of manufacturing industry. Whether current scientific research can be made widely available for some considerable time, who can assertively say plastic use will be

replaced entirely, and when will it be stopped using? To continue the deeper studying of potentially fruitful plan with considered sustainability, we need the lessons learnt from history and a broader view of packaging development. Whatever the plastic will disappear in packaging manufacturing might come up, reducing the damages and improving its value in use are urgent today. As a previous argument by Kirsi and Tenkanen (2012), plastic permanently left once we use it.

References

- [1] Radhakrishnan, S (2016). Environmental implications of reuse and recycling of packaging. Springer Science + Business Media Singapore
- [2] Lewis H, Verghese K, Fitzpatrick L. Evaluating the sustainability impacts of packaging: the plastic carry bag dilemma, *Packaging Technol Sci* 2010;23(3):145-60
- [3] Muthu, S. S. (2016). Environmental Footprints and Eco-design of Products and Processes. Springer.(n.d.).
- [4] Gonzalez-Garcia, S and more (2016). Sustainable design of packaging materials. Springer Science + Business Media Singapore.
- [5] Information on <http://businesscasestudies.co.uk/incpen/packaging-and-sustainable-development/introduction.html#axzz4Rz8BDBJD>
- [6] Information on <http://www.packagingdigest.com/sustainable-packaging/why-the-2030-sustainable-development-goals-matter-to-packaging-professionals1512>
- [7] Information on <https://dx.doi.org/10.106/j.rser.2016.06.072>
- [8] Information on <https://www.unilever.com/sustainable-living/the-sustainable-living-plan/reducing-environmental-impact/waste-and-packaging/>
- [9] Information on <https://saferenvironment.wordpress.com/2009/01/23/sustainable-packaging-packaging-waste-reduction-and-development-of-biodegradable-plastics-for-packaging-%E2%80%93-means-to-promote-cleaner-environment/>