

In focus

Problems posed by plastic



Emotive and high on the corporate agenda, plastic reduction is a complex issue. Plastics play a critical role throughout the food and beverage supply chain and whilst technical plastic reduction solutions exist, the fragmented regulatory, policy, infrastructure and consumer landscapes can make finding a viable alternative seem like an impossible task.



The food and beverage industry is a major contributor to the global plastic waste problem and for good reason. Plastic has become a staple packaging material due to its proven safety, cost and transport efficiency, which in turn has led to its use not only as finished product packaging but throughout the supply chain as well. However, with an ever-growing public focus on plastic reduction, a fragmented and sometimes contradictory regulatory landscape, huge variability in recycling infrastructure at both the national and global level, and the need to manage consumer expectations for price and convenience, there is a pressing need for viable solutions.

Types of plastic you need to know about

The most commonly recycled plastics are Polyethylene Terephthalate (PET) and High-Density Polyethylene (HDPE) used to produce soft drink bottles and milk containers, although every type of plastic can technically be recycled. The cost of processing and the lack of available infrastructure are the two main limiting factors which prevent more plastic from being recycled.

Fragmented global infrastructure for recycling

Although by no means a comprehensive solution, recycling schemes have been initiated around the world as an immediate response to the plastics issue and uptake is increasing year on year. Countries such as Czechia, Germany and The Netherlands lead the way in Europe with over 40%¹ of their plastic packaging being recycled through co-ordinated, well-planned and supported schemes.

This is in stark contrast to USA consumers, who recycled only 9% of their plastic in 2016 according to the British Plastics Federation (BPF)¹. Furthermore, this figure could drop further due to the trade sanctions with China – a market leveraged by the USA to outsource recycling in the face of increasing plastic waste and the lack of a national solution.



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¹ https://www.bpf.co.uk/sustainability/plastics_recycling.aspx

Food packaging regulations

The regulations for food packaging centre around consumer safety. The EU, for example, have specific regulations on the methods and procedures for recycling plastic used in food contact materials, such as Regulation (EC) No 282/2008 and 2023/2006. These are reinforced by the European Food Safety Authority who must approve all food packaging using recycled plastics.

The regulations within this area are constantly evolving with support from governments, retail consortiums and environmental groups and will consider factors such as the prevention of taints and potentially harmful chemicals migrating in to food from the packaging.

The EU has recently published Directive (EU) 2019/904, to reduce the amount of single use plastics entering the marine environment, by promoting the use of circular economies within plastic manufacturers.

The consumer landscape

The International Organisation for Standardisation (ISO) sets out specific guidance on plastics labelling including class number and the type of plastic, however the public are confused as to which type of plastics can and cannot be recycled, and there are differing attitudes to recycling amongst consumer groups.

70% of consumers we recently surveyed² actively looked for products with less plastic, particularly the over 50s. 79% of this age group responded that they were actively reducing their plastic usage as opposed to 64% of millennials. However, whilst the over 50's would compromise on convenience for this, it was the millennials who were more willing to pay for the privilege: 67% of whom were willing to spend up to 10% more for reduced plastic packaging. Most also felt that it was the responsibility of the industry giants to address the plastic issue, not down to the individual.



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Alternatives to plastics to be aware of

Increasing consumer and policy pressure to seek plastic alternatives is spiking innovation in the sector. Non-plastic or 'green' packaging is a core area for food and beverage companies that can broadly be split into three categories:

1. Biodegradable forms of plastic
2. Complete replacement of plastic
3. Edible packaging

1. Biodegradable plastics

Used for the last decade, the major benefit of biodegradable plastics is that there is little supply chain disruption or consumer adoption challenges. Packaging can, in theory, be recycled or composted, and should it enter the environment in an uncontrolled manner, will biodegrade significantly faster than traditional plastics. However, some of these plastics do require some very specific composting conditions that limit this benefit. Furthermore, large amounts of this type of packaging are also still being incinerated due to recycling processing plants lacking capacity and/or the inability to recyclable elements such as caps and lids.

² Watkins, R., (2018) Plastics and packaging. How much are consumers willing to compromise? Leatherhead Food Research white paper number 66

2. Complete replacement of plastic

Complete replacement of plastic involves the substitution of plastic packaging types with materials composed of biological materials such as soy, starches, cellulose and protein isolates that are easily broken down in the environment. However, implementation of these biological packaging systems requires several physical and mechanical hurdles to be overcome compared to traditional packaging. These include brittleness, water and oxygen permeability, and poor impact resistance. These factors negatively impact the sensory qualities of products, as well as their safety and stability, by poorly maintaining pH, water activity and gas migration. As a consequence, common challenges include retaining the shelf life of products to prevent excessive food wastage, or a rethink of the current operating model. Not impossible but by no means a quick solution.

To overcome some of these challenges, various methods have emerged to combat the inherent weaknesses of biological packaging. For example: coatings, polymer fillers and chemical modifications such as cross-linking. To illustrate this point, a 25 nm coating of aluminium oxide can significantly reduce the porosity of 'natural' packaging to air and moisture, as can the nanofiller montmorillonite, which has been reported as reducing oxygen permeability by up to 50%³.

3. Edible packaging

A third option is also slowly emerging - edible packaging. Edible plates and food containers e.g. bran fibre bowls, are appearing in the food service sector and demonstrating a strong proof of concept that meets a compelling consumer need. On a larger scale Diageo has recently launched a brand of edible flavoured straws to match their premix drink cans.

Having initially focussed on rigid containers coated with food grade wax, innovators are now turning to films. Whilst technically feasible, the industry is seeking a simple, scalable solution that delivers all the desired characteristics such as strength, moisture resistance and transparency.

A recent study using chitosan-gelatine composite films has shown potential for packaging of raw beef steak, matching existing packing for microbial resilience and maintenance of visual quality⁴. Starch films also show potential and whilst demonstrating comparatively poor mechanical properties when used in isolation, when reinforced with protein and lava flack fibre can provide a 25% increase in strength and reduce air and moisture permeability by up to 45%⁵.

These advances in film technology have now allowed water and flavoured still drinks to be encased in edible pods. This area of research is currently focused on the sports market, allowing runners to carry water whilst eliminating the problem of what to do with the empty plastic bottle.

The downside to this alternative is largely related to CAPEX requirements for new packing lines coupled with an uncertainty of the market readiness for such concepts.

In summary

Plastics play an important functional role throughout the food and beverage supply chain, but ultimately their use must be limited to where it is essential. Technical solutions exist but these are product and market specific, respecting the different regulatory and policy landscapes, as well as the varying requirements of the end-user and product type. There is an opportunity for brands to differentiate in this space and charge a premium for doing so, but the business case, at least in the short term, will be a risky one.

Read more

Leatherhead's sister company Oakland Innovation have explored end of life plastic strategies. They believe there are seven key factors which organisations need to consider when putting together their end of life packaging strategies: the consumer; the regulatory landscape; functionality; design; recycling infrastructure; materials and taxation.

Find out more by visiting oaklandinnovation.com

³ Wei-Han et al. (2018) Food Packaging: A Comprehensive Review and Future Trends. Comprehensive Reviews in Food Science and Food Safety, Vol 17(4).

⁴ Cardoso, G. et al. (2019) Retail display of beef steaks coated with monolayer and bilayer chitosan-gelatin composites. Meat Science, Vol. 152, p. 20-30.

⁵ Chen, Y. et al. (2019). Preparation and characterisation of edible starch film reinforced by laver. International Journal of Biological Macromolecules, Vol. 129, p. 944-951.

About Leatherhead Food Research ▾

Leatherhead Food Research provides expertise and support to the global food and drink sector with practical solutions that cover all stages of a product's life cycle from consumer insight, ingredient innovation and sensory testing to food safety consultancy and global regulatory advice. Leatherhead operates a membership program which represents a who's who of the global food and drinks industry. Supporting all members and clients, large or small, Leatherhead provides consultancy and advice, as well as training, market news, published reports and bespoke projects. Alongside the member support and project work, our world-renowned experts deliver cutting-edge research in areas that drive long term commercial benefit for the food and drink industry. Leatherhead Food Research is a trading name of Leatherhead Research Ltd, a Science Group Company.

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