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Breaking up with plastic

Technical steps to rethink, replace and reduce plastic packaging

Reducing plastic waste is one of the great challenges of our age. Tackling it sensitively, effectively and with commercial sense requires purposeful action, not just words and policies. Sagentia's Matthew Herd, Simon Norman, Andy Potter and Stephen Brown say it's important to acknowledge the scale and complexity of the issue, then address it with applied scientific and engineering expertise.

> "Gaining control of plastic waste [will involve] rethinking plastic chemistry, product design, recycling strategies and consumer use."
>
> Jenna Jambeck,
>
> Environmental engineer specialising in the study of plastic waste in oceans (National Geographic, July 2017)

Problems associated with plastic waste have been known about for some time. But when celebrities, scientists, politicians and businesspeople turn environmental activists, it's clear that something has changed. Consumer awareness of plastic pollution and its repercussions for land, air and sea is also on the rise.

The stats make sobering reading. One refuse-truck worth of plastic is dumped into the sea every minute. More than one million plastic bottles are sold every minute. By 2050 there will be more plastic than fish in the oceans. The list goes on.

Plastic packaging used for everyday products – from food and beverages to personal care items – is a large part of the problem. And attitudes are shifting. People are starting to take a stand against the amount used on the products they buy, especially when it's perceived as unnecessary.

It's not just consumers and environmental campaigners driving the agenda. Governments and organisations around the world are introducing measures to curb plastic use and encourage recycling. We have reached a watershed moment: rules, regulations and policies to reduce plastic waste will almost certainly continue to escalate. And there is mounting pressure on industries to tackle the issue at source.

¬ The corporate response

Facing a perfect storm of consumer pressure and policy change, many businesses are actively reviewing the use of plastic packaging in product lifecycles. Reducing its use – or maximising reuse – is an important element of social and environmental responsibility. It can also underpin competitive differentiation and commercial advantage. But it is a complex issue. In some cases, it's simply not yet practical, cost-effective or even sustainable to do away with single-use plastic packaging. Unless this is openly acknowledged, there is a risk that gaps will remain unclosed and plastic waste reduction initiatives will fail to properly address the matter.

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¬ Technical steps to design out plastic

In many situations, plastic packaging does more than simply 'contain' a product. It can play an intrinsic role, from preserving food and beverages to maintaining sterility of personal care and medical items.

Eradicating plastic from these applications can require a complete overhaul of products and processes. It also demands detailed analysis of the environmental conditions products are exposed to after the point of manufacture, during distribution, storage and use.

Re-engineering such products and their packaging for reduced reliance on plastic is not an easy task. It requires sector and consumer insight as well as scientific and engineering expertise. At Sagentia, we've developed a three-phase technical framework to focus and accelerate the process:

1 Collaborative front-end planning

In applications where plastic packaging performs a functional task, designing it out of the equation may require a fundamental reimagining of the product.

Every product design or redesign project has parameters or 'redlines' to be adhered to. Generally, these relate to factors such as size, weight, price point or ease of manufacture. Redlining plastic reduction or recyclability as a core design feature is an effective way to focus R&D attention. But since individual elements of a product are often considered in isolation, finding ways to address this cohesively can demand new ways of working.

Much of the time, development of a food or consumer item is handled separately to the packaging for the same product. Likewise, the design of a durable product such as a pod coffee machine is managed by a different team to its consumable elements. This siloed approach is not conducive to overcoming the plastic waste issue. It is always someone else's problem.

With better upstream collaboration and cohesive project management, reducing plastic packaging becomes a shared responsibility. And the full depth and breadth of product development, manufacture, distribution and consumption is factored into a project scope. This can reveal insights and opportunities that might otherwise be missed. For instance, minor adjustments to a product could result in lower demands being placed on its packaging. Relaxing these requirements might unlock new potential for eliminating or reducing plastic or enhancing the recycling or reuse of individual packaging components.

In some cases, there could be merits in challenging the received wisdom about how products are designed and presented. Holistic thinking across multiple teams might result in breakthrough product innovations that eliminate the need for plastic packaging. For instance, instead of looking at recyclable or bioplastic bottles for shampoo and conditioner, how about creating haircare bars that can be packaged in a biodegradable wrapper? You start with the desired outcome – e.g. clean hair – and work from there, rather than starting with the bottled product and assuming there is no alternative. In this example, collaboration would be required between customer insight specialists and manufacturing and logistics teams, as well as product developers.

2 Scoping out the technical role of plastic

There is a reason plastic is used so extensively as a packaging material: it performs the role very well. Its versatility means it can be shaped, moulded, cast, spun or used as a coating. It can be rigid or malleable, it's lightweight and hygienic.

Rheological properties of personal care products – such as toothpaste, creams and lotions – are maintained well within plastic packaging. It's cheaper than glass, and more user-friendly than aluminium.

In food and beverage applications, plastic provides an effective barrier to oxygen, inhibiting growth of microorganisms, extending shelf-life and enhancing food safety. There are interconnected sustainability issues where plastic can play a positive role – such as reducing food waste.

It's important to acknowledge the benefits of plastic and appreciate the scale of the task it performs on a case by case basis. From this vantage point, it's possible to interrogate the demands placed on packaging to ascertain whether they can be relaxed or met in different ways. Do consumers really need fruit juice with a two-month shelf life, or meat that's good in the fridge for ten days? Will alternative packaging materials harm safety or the overall experience of the product? Family feuds over who squeezed the middle of the toothpaste tube are largely a thing of the past thanks to plastic. Is it possible to rethink the way toothpaste is presented without compromising hygiene or ease of use?

Scientific, engineering and consumer behaviour expertise are critical here. It's only by understanding the full technical requirements of packaging - from point of manufacture to point of consumption - that alternatives can be discovered and properly tested. In circumstances where plastic packaging is deemed necessary, it could be redesigned to perform the same important functions without compromising recyclability. Avoiding multi-material laminates and polyethylene linings on paper or card would be a good place to start.

3 Considerate design

Successful design strikes an effective balance between empathy and reason. When designing out plastic packaging, this can manifest itself in many ways.

Consider the durable / consumable business model used across various applications, from desktop printers to pod coffee machines to razors and blades. Better engineering of the durable product could reduce the demands placed on consumable elements. If pod coffee machines were designed to handle more of the pressure required during the brewing process, the pods themselves wouldn't need to be so robust. They could be redesigned for separability, perhaps using a secondary foil wrapper rather than integrated aluminium in the casing. This would offer easier disassembly and washing for reuse or recycling by the consumer.

Consumer insights can actively inform strategies to reduce plastic waste too. The subscription model favoured by some daily contact lens users is a prime example. Users typically receive 30 pairs per month, but if they don't choose to wear them every day, a backlog builds up. Intelligent packaging with embedded sensor technology enables manufacturers to understand an individual's usage habits. This can underpin a tailored pricing and distribution strategy based on real need, reducing unnecessary waste and boosting customer loyalty. In time, this could result in the ability to minimise shelf-life requirements of lenses, unlocking the potential to reconsider the packaging materials used.

However, considerate design can be problematic, as a current UK debate over plastic drinking straws highlights. Politicians are calling for a ban, and many high-profile food and beverage outlets intend to stop using straws, or switch to paper alternatives. It is a move that seems to be widely supported by consumers. But disability groups have urged caution. For people who can't drink from a cup unaided, plastic drinking straws are an important tool for wellbeing and independence.

It's important to consider the ripple effects of each decision on the plastic reduction journey. This includes impacts at various stages of the product lifecycle, with different stakeholders and audience segments.

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¬ Conclusion

Strong, durable, inexpensive and versatile: core properties of plastic make it ideal for packaging, but they are also at the root of the pollution problem. The low price has fed a 'use it once and throw away' culture. And when plastic isn't disposed of properly, its durability means it hangs around for a long time.

¬ So, what's the best way forward?

Sectors that are synonymous with single-use plastic need to tackle the issue purposefully and intelligently. That means having courage to address thornier aspects of plastic waste, and not simply paying lip service with solutions that don't go far enough. There are some quick wins to be had – and these should be seized. But in many cases, eradicating plastic or replacing single-use plastic with reusable or recyclable alternatives is highly complex. There are multiple factors to consider, from ensuring product safety to finding ways to shift consumer behaviours and expectations.

The task is difficult, but not insurmountable. And it can be embedded with wider business strategies. As shopping habits evolve and personalisation demands escalate in the digital age, many manufacturers will need to reinvent their offering. This is an opportunity to develop alternative models that are less reliant on single-use plastic.

Solving the plastic packaging problem cannot be achieved in isolation. Cross-departmental collaboration is essential. Cross-industry or inter-industry projects would be even better. The scale and urgency of the challenge demands the application of the brightest minds in science and engineering, sooner rather than later.

¬ Authors' biographies

Matthew Herd

Matt is a senior product design consultant and specialises in product design engineering with a human factors and UX focus. He joined Sagentia over seven years ago from an industry position in a start-up developing leading-edge motorbike helmet technology.

His interest in plastics reduction comes from his involvement in the design and management of new consumer product developments from first idea through to full manufacture.

Simon Norman

Simon is a consultant in Sagentia's applied science team. Focusing on the front end of innovation, he specialises in industrial chemistry, materials and fundamental scientific analysis of client challenges.

He holds academic qualifications in organic chemistry, synthetics methods and catalysis and has been with Sagentia for almost 5 years, joining from University. He is passionate about designing products without reliance on plastic and has been involved in many projects focused on minimising the use of conventional plastics.

Andy Potter

Andy is a consultant specialising in chemistry, materials and fluidics and has been with Sagentia for more than 5 years. Previously, he worked for an alternative energy start-up.

Andy's interest in plastics and plastic reduction comes from his experience in many projects where choosing the right materials for a wide range of different tasks has been key to project success.

Stephen Brown

Steve is a senior consultant and team leader in Sagentia's mechanical systems group. He is a chartered engineer and has a background in applied physics. He has been with Sagentia for 9 years and specialises in designing for manufacture and continuous improvement.

Prior to joining Sagentia, Steve undertook a number of product and technology design roles in digital inkjet printing, automotive components and medical devices.

About Sagentia

Sagentia is a global science, product and technology development company. Our mission is to help companies maximise the value of their investment in R&D. We partner with clients in the consumer, industrial, medical, agricultural and oil & gas sectors to help them understand the technology and market landscape, decide their future strategy, solve the complex science and technology challenges and deliver commercially successful products.

Sagentia employs over 150 scientists, engineers and market experts and is Science Group company. Science Group provides independent advisory and leading-edge product development services focused on science and technology initiatives. It has 16 European and North America offices, two UK-based dedicated R&D innovation centres and more than 400 employees. Other Science Group companies include OTM Consulting, Oakland innovation, Leatherhood Food Research & TSG Consulting.

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