WHY PRODUCTS ARE PACKAGED THE WAY THEY ARE

INCPEN is a research organisation, which draws together an influential group of companies who share a vision of the future where all production, distribution, and consumption are sustainable. It aims to:

·ensure that policy on packaging makes a positive contribution to sustainability.

·encourage industry to minimise the environmental impact of packaging and packaged goods and continuously improve packaging.

·explain the role of packaging in society.

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INTRODUCTION

The average household in the UK buys over 4,000 items of food and other products every year. In the UK as a whole, 25 million households buy over 100 billion items every year. Over 75% of those purchases are grocery products – mainly food and drink but also household detergents, paper products, cosmetics, toiletries, nappies and pet food.

Modern society and consumers demand a wide range of products to meet the complex needs of today's lifestyles, including food products sourced globally for year round consumption. A typical supermarket today carries well over 50,000 product lines compared with only 2,000 in the 1960s. These products have to survive the journey from farm or factory and reach the consumer undamaged, unspoilt and fit for purpose.

Most of them need to be packed in sales (or primary) packaging to protect and contain them – the tin of soup, the glass jar of jam, the box of cereals or the plastic bottle of washing up liquid for example. This is the packaging that appears on the shop shelf but cans, bottles and fresh fruit and vegetables cannot be put loose into a lorry.

Secondary packaging such as cardboard boxes, plastic wrapping and trays are used to group them during distribution. These in turn are stacked on pallets or trolleys – to allow them to be transported in bulk, stacked in depots and stored in hot and cold climates.

Packaging for food and drink accounts for 87% by weight of all sales packaging.

Packaging is an integral and essential part of the industrial and commercial supply chain. It protects goods from damage, allows efficient transport distribution, offers convenience, prolongs shelf-life, enables easy use, informs the consumer and helps to promote goods in a competitive market place.

Sales packaging by type of product percent by weight, 2007

Home and Interior	**3%**
Education, Recreation, Transport	**4%**
Clothing, Personal and Home Care	**6%**
Food & Drink	**87%**

source: Valpak

Effective packaging:

- Contains the product in appropriate quantities (we only want tiny quantities of some things, such as vanilla essence or plant seeds, and while families may need 4 litres of milk, people living alone may only want 500ml)
- Protects the product from damage or spoilage or from tampering or theft
- Ensures effective and efficient handling, storage, delivery and transport of the product throughout the supply chain
- Informs consumers by providing all legally required information about the product, its storage and use
- Presents the product to the consumer, identifying brands and the properties of the product.
- Makes the product easy to open and sometimes re-close, use and store at home.

By protecting the product, packaging also prevents waste of the energy, fertiliser, raw materials and water that went into growing or making goods and the energy used to transport the goods from the producer to the retailer.

This publication explains the reasons why 12 frequently bought grocery products are packaged in the way that they are. It explains the considerations that a product manufacturer has to take into account to find a balance between:

- providing adequate protection for the product
- minimising the overall environmental impact of the product and its packaging throughout its life
- delivering the product in a way that helps consumers use it responsibly

... and at an acceptable cost.

The 12 products chosen are not intended to represent all types of packaged product. They represent a range of food and non-food items likely to be found in a typical UK shopping trolley or basket. Each of them needs protection from a variety of external and internal factors such as dirt, light, moisture, oxygen, bacterial growth, temperature and physical damage on their journey from farm or factory to storage at home.

The technical and other data on packaging design was provided by Alison Vincent of AVA Packaging Solutions, AVA-packaging.com. Other data were added from a number of INCPEN publications including Table for One and Towards Greener Households.

1. BREAKFAST CEREAL

In the 1960s half of Britain's population tucked into a cooked breakfast before going off to school or work. For a variety of reasons, including time pressures and health concerns, only 10% of us eat a cooked breakfast today, 50% start their day with a bowl of cereal.

Britain is Europe's largest consumer of breakfast cereals. On average each of us munches through 6kg every year. Most households have four or five different packs in their kitchen cupboards.

Different breakfast cereals have different densities – dense (heavy) ones are in smaller boxes than the same weight of a lighter cereal which takes up more space and needs a bigger box.

Breakfast cereals are light and fragile and need packaging that stops them being crushed and keeps out moisture to prevent them going soggy.

The packs also have to fit into kitchen cupboards. Most cereal packs contain multiple servings but there are also single-serve selection packs sold grouped together.

Packaging for cereals accounts for just over 2% of all sales packaging.

Boxes and liners

Most cereals are sold in boxes (known as cartons) with inner plastic bags (known as liners). The bags are made from a sheet of plastic which is sealed after filling to form a bag.

Liners are needed to prevent odours or moisture affecting the contents. They are made of a number of layers of different types of plastic laminated together.

Do you know why breakfast cereals are not filled to the top of the box?

The main layer is usually polyethylene (PE) which provides some stiffness, a barrier to moisture and good heat-sealing properties. Polypropylene (PP) and polyethylene terephthalate (PET) are sometimes used as the main layer in the laminate 'sandwich'.

Bags are filled before being inserted into the box on the packing line. If the bag was designed to completely fill the box, it would be impossible to fit it into the box. You can try this for yourself – open a box of cereal and remove the bag; shake it and then try to put the bag back into the box with the box upright. Not easy, is it? Now imagine trying to do that 200 times a minute. That is the speed of the factory filling line.

The product settles during filling and transport so there is always some headspace when the pack is opened. Manufacturers do as much as possible to reduce it. Some have equipment to gently shake the packs to encourage settling during filling.

The carton has a high recycled content – often 80%-90%. Cartons are sealed and have a reclosable top. The carton is easy to stack on shop shelves and to store in kitchen cupboards. The surface of the carton is readily printed so the product stands out on the shop shelf making it easy for consumers to identify.

Cereals packed in this way keep fresh for more than 12 months.

They are sold in a variety of pack sizes to fit different consumption patterns. 500g of product is typically packed in a 70g carton and a 7g liner. This means 3.8g of packaging for a 25g serving of cereal.

Single-portions are packed in smaller versions of the carton and liner combination and sold in multipacks, grouped together with a thin plastic film wrap. Single-portions range in size from 17g – 30g depending upon the density of the cereal. The ratio of packaging per serving is much higher than bigger packs and can be up to 50%. However, single-portion packs are convenient, provide variety and reduce the possibility of product wastage.

Most local authorities provide recycling collection facilities for cartons.

Sealed bags

Bags are used for cereals that are denser and less fragile than cornflakes, such as muesli.

The laminated bag structure typically comprises an outer layer of PET (which may have a very thin metal coating) or PP and an inner PE layer, which ensures good heat sealing.

This provides a good barrier to moisture, odour and gas. The bags usually have a reclosable top and shelf life can be up to two years.

A laminated bag for 750g of cereal weighs 10g – or 0.4g per 25g single serve.

Cartons without liners

Cartons without liners are sometimes used for cereals such as porridge oats.

A PE coating on the cardboard provides a moisture and odour barrier. The shelf life is similar to the carton plus liner combination.

A 1kg carton weighs 66.5g – a typical 50g serving is protected by 3.3g of packaging. The PE coating does not prevent recycling and cartons are sometimes collected at recycling centres or via kerbside collection.

2. CAT FOOD

There are over 10 million cats in the UK and they all need to eat – usually several times a day. In the past we fed them moist or semi-moist food from cans, but recently the trend is for drier, less bulky and lighter food sold in a variety of new kinds of packaging.

Instead of 400g of moist food, now the typical cat eats 70g of dry food and dry food accounts for 27% of the market.

This shift from moist to dry has stimulated numerous packaging innovations to ensure a long life – both in the retail store and at home.

There are a greater number and variety of pack formats for cat food than for almost any packaged food item for humans.

Did you know that there are more varieties of packaging for cat food than for any packaged food for humans?

Packaging for moist food has to ensure moisture is not lost from the food; conversely, for dry food the pack has to ensure that moisture is kept out.

Cat food is generally stored at room temperature.

Pouches

Pouches – or small flexible packs - are now the most popular packaging and are used both for moist and dry food. A pouch generally provides a convenient single meal compared with larger containers which need to be re-sealed.

Pouches for dry food are a laminate (or layered) structure of either polypropylene (PP) or polyethylene terephthalate (PET) film with either an aluminium foil or ethylene vinyl alcohol (EVOH) layer.

Pouches for moist food are more complex as the food has to be cooked in the pouch after filling. They typically have an outer layer of PET or nylon, a centre layer of aluminium foil or EVOH to provide barrier properties (keeping oxygen out and moisture in) and an inner layer of food-grade PP, which is in contact with the food and facilitates heat sealing of the pouch after filling. Pouches usually have an easy-open tear strip. The shelf life of cat food in pouches is around 12 months.

Pouches are lighter than cans – typically 100g of moist cat food is contained in a 3.3g pouch, which typically costs 8 pence.

The print on pouches is usually 'sandwiched' within the laminate. This protects it from being scuffed and ensures a high quality appearance which helps pouches stand out on the shelves.

Pouches are less robust than cans, so need more secondary packaging to protect the product as it moves through the supply chain.

Pouches are rarely collected for recycling because it is not worth spending more resources and energy on sorting and cleaning them. Energy will be recovered in parts of the country (12%) that use energy-from-waste plants. In other areas the packaging will be sent to landfill. It is inert and therefore does not give off methane.

Cans

Although other sizes are available, the standard can holds 400g of moist food.

The body of a can is made from steel, lined on the inside with a food-contact approved lacquer that prevents interaction of the food and the steel. The top is made from steel and most have ring-pull openings.

Cans are robust and so can be filled on very high speed filling lines that operate at speeds of 400 cans a minute. Canned food has a shelf life of up to three years.

A 400g can weighs 54g - one-third lower than it was 20 years ago due to improvements in material and process technologies and product design.

Cans need less secondary packaging to protect them in transit compared with other formats. An easy-open can typically costs 16p.

Cans are widely collected and recycled.

Trays

Aluminium trays are the third-largest packaging format for moist food but are declining in popularity compared with the pouch even though cats can eat directly from the tray while cans or pouches have to be emptied onto a saucer or bowl that needs washing after use.

Trays are used for 80g-100g single-portion servings. The tray and lid weigh 4g-5g and if four trays are needed for daily feeding, this means the amount of packaging per day is 16g-20g.

The tray has an aluminium/polyethylene (PE) laminate lid – the PE providing a good heat seal after the tray is filled. Like pouches and cans, the moist food is cooked in the aluminium tray and it has a long shelf life of three years.

Despite being made of aluminium, trays are seldom collected for recycling because they contain so little material and they often contain residues of food. To get one tonne of material for reprocessing, over 250,000 trays would need to be collected, sorted and cleaned.

Bags

Some dry food is packed in large sealed bags which provide multiple portions. They are the least expensive packaging format and have the lowest ratio of packaging to product of all the pack types.

The bags (called vertical form fill seal bags) are made of a complex laminate structure. An outer layer of PET film, which is very strong and puncture resistant and provides a good surface for high-quality reverse print for print protection and scuff resistance, a middle layer of nylon or aluminium foil to provide the necessary oxygen and moisture barrier and an inner layer of food-contact approved PP, which allows heat sealing of the bag after filling.

A bag weighs 22g for 1kg of contents and provides a shelf life of 12 months. 1.5g of packaging protects the daily feed of 70g of food.

The light weight and multi-material laminate structure of these bags means it is not worth spending more energy and resources on collecting, sorting and cleaning them for recycling.

Cartons

Paperboard boxes, known as cartons, are also used to pack dry food. They are usually lined with either PE or a grease resistant chemical so that grease will not transfer to the pack from the food and to ensure that moisture will not enter the pack through the pack walls. Cartons often have a perforated opening at a top corner to allow the food to be poured and the box re-closed.

A carton designed to hold 950g of dry cat food typically weighs 85g or 6g of packaging per daily feed – much less than cans and pouches but more than bags.

Cartons are widely collected for recycling. The lining or coating does not cause difficulties in the recycling process because there is so little of it.

3. COFFEE

Coffee is sold in three different forms: instant powder or granules, ground beans or whole beans.

Instant coffee was market leader for many years but sales of ground coffee overtook it in 2009 after rising by 50% in the last five years on the back of the café culture and the related demand for better taste in coffee drunk at home.

The energy used to make packaging for coffee is 6% of the total energy used to grow, harvest and process and make a cup of coffee. The energy used to heat water at home is 51% of the complete supply chain energy. That is why it is important not to boil more water than is needed at any one time.

Do you know why bags of coffee have a valve in them which allows gas to escape?

Pouches

Pouches – or flexible packs - are the main form of packaging for roasted ground and for whole beans. Pouches are now also being used for instant coffee refill packs.

They are made typically from a 3 layer 'sandwich' or laminate made of polyethylene terephthalate (PET) film, which is easy to print on; aluminium foil, which provides an oxygen and moisture barrier; and polyethylene film, which provides a moisture barrier as well stiffness, puncture resistance and heat-sealing capability.

There are also some all-plastics pouches.

Coffee needs to be packed quickly after roasting to prevent its flavour escaping. However, it also emits carbon dioxide so the packaging has to include a pressure release valve which allows the gas to escape and also retains the flavour.

Packs are also usually flushed on the filling line with an inert gas such as nitrogen which helps preserve aroma and flavour and increases the storage life from a few weeks to up to 18 months.

Pouch packs are very light - 227g of coffee is usually contained in a pouch weighing 10g. They are easy to open and can generally be closed.

Jars

Instant coffee is hygroscopic (it attracts moisture) which causes it to go into damp clumps and its taste deteriorates. It therefore needs to be packed under low humidity conditions in a moisture-proof container. Glass is an excellent barrier to moisture.

Some instant coffee is packed in polyethylene terephthalate (PET) jars but PET by itself does not provide a sufficient barrier to moisture. A thin coating of silicon dioxide which increases the barrier to moisture is applied to the inside of the jar.

Jars are hermetically sealed with a thin layer of foil/polyethylene/paper laminate, which provides an oxygen and moisture barrier, and provides tamper evidence. A lid made of polypropylene goes over the sealing layer. Jars are labelled with either a wrap-around paper or self-adhesive label or, increasingly, with a PET shrink sleeve.

Some settling of the coffee occurs in the jar as it moves through the supply chain so when it is opened there is always a space at the top.

Instant coffee is packed in a wide range of sizes to meet different consumers' needs.

Typically, a 280g glass jar is used to pack 100g of coffee. Glass jars are widely recycled and all glass containers contain a significant proportion of recycled glass.

Other

There are other relatively low-volume retail packaging formats for niche markets such single serve capsules, sachets or pouches for use with in-home machine systems, cans and a 'brick' shaped laminate pack.

4. CRISPS

UK consumers eat 4 billion packets of crisps a year, made from 600,000 tonnes of potatoes.

Crisps contain fats that oxidise rapidly if exposed to air and light. This makes them taste rancid. They also quickly become soggy if exposed to moisture. Their packaging therefore has to be designed to act as a barrier to air, light and moisture.

Historically, crisps were packaged in paper bags, which kept out light but did not protect them from oxygen or moisture so they quickly turned soggy and sour. In the 1950s, to try and keep them fresh, manufacturers packed the bags in sealed tins. Salt was provided in the bag in a small twist of blue greaseproof paper to keep it separate from the crisps until just before eating. In the 1960s Golden Wonder started using bags made from plastic which provided a barrier to moisture. This meant the salt could be added directly to the crisps - the first ready-salted crisps.

Today's bag is a multi-material laminate. It contains a 'modified atmosphere' – typically nitrogen gas – which reduces the oxygen content within the bag and delays rancidity.

The bag is usually made from metallised oriented polypropylene (OPP). Polypropylene provides a good barrier and this is further improved by 'orienting' it. Orienting means stretching the polymer to align its molecules. It is 'metallised' by putting it in a vacuum and applying an extremely thin layer of aluminium that is hardly thicker than a molecule.

Some bags are a laminate of metallised and unmetallised OPP which is typically 40 microns thick. A strand of human hair is 100 microns.

Did you know that crisp bags are 40 microns thick — that's less than half the thickness of a human hair?

As well as helping keep the crisps fresh, the nitrogen keeps the bags inflated, which cushions and protects the crisps during their journey through the supply chain. The bag has to contain enough gas to ensure it remains inflated even in cold conditions which is why in warm environments at home or in the shop it can look very blown up and on opening there appear to be far fewer crisps than the bag could contain. However, if more crisps were added, they would be crushed in the cooler conditions in the supply chain.

Single bags are sometimes multi-packed in a larger 35micron bag.

Crisps have a shelf life of around 16 weeks. 25g of crisps are contained in a 1.3g bag. Even bags for 150g of crisps weigh only 6.2g.

Because of their light weight, multi-material structure and because the bag contains residues of oil and salt, it is not worth collecting and cleaning them for recycling.

A significant proportion of crisps are eaten on-the-go so most manufacturers include the Tidyman logo or a variation of it on the bags to encourage consumers to dispose of it in a bin.

5. HOUSEHOLD CLEANERS (TRIGGER SPRAY)

Packaging for all types of household cleaning products accounts for 3.6% of sales packaging on the UK market. Trigger sprays allow a controlled amount of liquid cleaner to be used. Consumers can accurately apply the cleaner without having to unscrew caps or directly handle it.

The cleaner is contained in a bottle and dispensed through a dip tube and a trigger spray in 500-750ml quantities. Some are sold in refill packs without the trigger so the trigger can be reused.

Bottles

The choice of material for the bottle is determined by the cleaner. The bottle must be stable and compatible with, but resistant to, the chemicals in the product. It must protect the liquid and not allow it to leak.

Bottles can be clear, translucent or opaque. Typical opaque materials are high density polyethylene (HDPE) and polypropylene (PP) with a colour; translucent bottles are usually moulded from natural or uncoloured PP; and clear bottles from polyethylene terephthalate (PET). A 500ml PET bottle weighs 40g and costs 11 pence. HDPE bottles are cheaper than PP and PET.

Bottles can be coloured or the contents can be coloured in clear and translucent bottles. Labels or shrink sleeves are used to carry information. Most local authorities collect plastic bottles for recycling.

Trigger sprays

These are complex, multi-component mechanisms. Pulling the trigger generates a pump action which draws the cleaner up the tube and then sprays it through a nozzle. The trigger is designed to deliver the right amount of product for the job in a spray pattern. Like the bottle, the tube and trigger have to be resistant to the chemicals in the cleaner.

PP is usually used for the components although there are some specialised gaskets and springs made of silicone rubber or metal. The trigger mechanism often has a tamper evident feature as well as a nozzle which must be twisted to open and close, to help prevent accidental spraying and provide a child safety element.

Trigger sprays weigh 26g and cost 9 pence. Any residual liquid should be removed from the bottle before recycling.

6. MEAT

Fresh meat has a high water and nutrient content and is susceptible to bacterial growth. Rotten meat is poisonous. Rearing meat is energy intensive and environmentally expensive so any meat that goes to waste has a high negative impact on the environment.

The average person today buys over 1kg of meat and meat products a week. This supplies 12% of an individual's weekly calorie intake.

The energy used to rear and process meat is 63% of the total supply chain energy. The energy to make the packaging that protects the meat is 4%.

Meat used to be bought daily from butchers, who cut it as required and wrapped it in greaseproof paper.

Meat that was not sold that day had to be wrapped and stored overnight. In the morning the outside would have oxidised and dried which meant it darkened in colour. It had to be trimmed off to expose the red meat. As much as 25% of meat went to waste in this way.

Did you know that as much as 25% of meat used to go to waste before modern packaging extended its storage life?

When supermarkets were introduced in the 1960s, in-store butchers usually prepared fresh meat. Instead of greaseproof paper, foamed polystyrene trays and PVC overwrap film was used which kept the meat fresh for longer - one to three days.

In the late 1980s a significant shift took place. Many supermarkets removed their in-store butchery departments to free up retail space. Fresh, chilled meat was prepared and packed in central packing

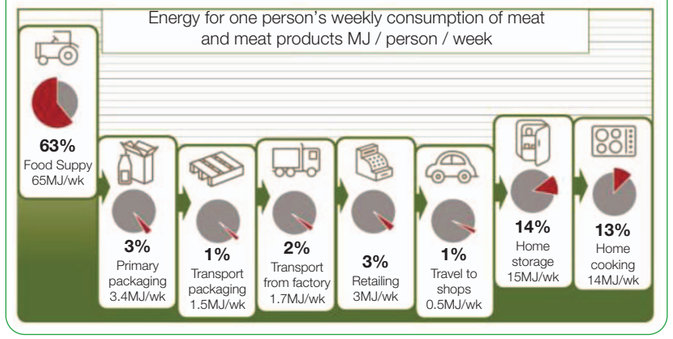
locations. This had the benefit that the meat off-cuts could be used for other products whereas in-store butchers usually threw them away.

However, central packing meant that it took more time for the meat to reach the shop shelves. At the same time, more women were working outside the home and consumers were increasingly shopping once rather than several times a week. Both these developments required the meat to have a longer shelf and storage life.

In the early 1990s a new development played a crucial role in reducing meat and other fresh food waste: modified atmosphere packaging (MAP).

MAP encloses a product in a specially modified atmosphere. The proportion of the gases that are normally present

Meat (includes meat products)



in the atmosphere are modified so they are present in precise proportions that slow down the growth of microbial organisms, retain nutritional value and ensure that the meat or other food keeps its colour. Chilling meat in the shop and at home also helps extend its shelf life.

The gases used to create the modified atmosphere for meat are: oxygen, which prevents anaerobic growth and keeps meat red; nitrogen, which prevents oxidation and rancidity; and carbon dioxide, which inhibits bacterial and mould growth.

The proportion of each gas is varied according to type and cut of meat. For red meat the most common mix is 60%-80% oxygen with carbon dioxide and for poultry 40-100% carbon dioxide with nitrogen . 100g of meat typically needs 100-200ml of gas, which means the pack has to be large enough to contain this amount. The gases are flushed into the packaging before it is sealed.

The packaging has to be leak-proof, odour-proof and able to maintain the balance of gases. A fail-proof hermetic seal is essential.

Shelf life of chilled meats in traditional packaging is one to four days but MAP increases this to 10-14 days or more, depending on type and cut of meat.

The tray for a MAP pack may look like a simple plastic tray but it is carefully designed to exactly protect the meat and carry out all the other functions required of it, including length of shelf life, strength, shelf presence (visibility) and cost. The depth of the tray depends on the type and cut of the meat, its surface area and the volume of gases needed to ensure adequate shelf life.

The main polymers used for the trays are: polyethylene terephthalate (PET), polypropylene (PP) and polystyrene (PS), which may be in expanded or rigid form. Some of these polymers are porous so a layer of ethylene vinyl alcohol (EVOH) may also be needed.

Usually a layer of polyethylene is added to the surface of the tray to ensure a good seal with the lid. Trays may have an absorbent pad at the bottom to absorb meat juices although expanded polystyrene trays can be designed to absorb the juices into the structure of the tray.

The tray is closed by a plastic film, which forms the lid. Like the tray, the film lid has to keep the gases in the pack. It too has a multilayer structure with each layer chosen to perform a different function. The main polymers are PET or PP with an EVOH or nylon layer which provides an additional barrier. Sometimes up to seven layers are needed to provide all the functions.

People want to see meat before they buy it so an anti-mist coating is often applied to the film to minimise condensation in the pack. Over 90% of fresh, chilled meat sold through supermarkets is now in MAP and most processed, uncooked meat products including sausages, kebabs and burgers are also sold in MAP.

The complex, multi-polymer nature and light weight of MAP trays and lids, and the fact that after use they usually contain residues of meat, means that it is not worth spending more resources and energy on sorting and cleaning them for recycling.

The fact that they are not recycled is more than offset, however, by the huge environmental benefit they bring in reducing meat waste. Energy will be recovered in the 12% of areas where municipal waste is incinerated. In other areas packaging will be landfilled but it is inert so does not give off methane.

7. MILK

We each drink 1.5 litres of milk a week and 5 billion litres a year are sold in the UK. WRAP research shows that 7% of milk is typically wasted in the home; other studies have shown that up to 25% may be thrown away. In addition, some goes to waste in the supply chain.

Traditionally milk was sold in returnable, refillable glass bottles delivered to the doorstep. However, lifestyles and consumer purchasing habits changed and doorstep deliveries now account for only 5%.

Sales through retail outlets using one-trip packaging now dominate the market. This shift has allowed the use of lighter-weight packaging because it does not have to be made strong enough to survive the pressures of a return/cleaning/refill system.

10% of liquid milk is long life and stored at ambient temperature; 90% is fresh and has to be kept chilled.

The difference depends on how it is treated. Pasteurisation is the most widely used treatment because it does not affect the taste or nutritional value of the milk. The milk is heated to over 70°C followed by rapid chilling to less than 5°C. It has a shelf and storage life of four to seven days if kept chilled.

Ultra-high temperature (UHT) milk is heated at over 136°C before being packaged into sterile containers. It does not have to be kept chilled and has a shelf life of six months under ambient conditions, provided it is not exposed to light. The packaging therefore has to keep light out.

Extended shelf life (ESL) milk is a relatively new product. Microfiltration followed by pasteurisation reduces the bacterial content of the milk to lower levels than pasteurisation alone. ESL milk retains the taste and nutritional values of pasteurised milk and has to be kept chilled but it has a shelf life of 14-28 days and 7 days after opening. Like UHT milk, the packaging has to provide a light barrier to protect against degradation of the fats in the milk.

Do you know why clear containers can be used for fresh, pasteurised milk but the containers for UHT milk have to keep the light out?

We buy 2kg of milk and milk products every week, which provides us with 8% of our calorie intake. Primary packaging accounts for only 8% of the energy used to produce, supply, store and use milk. The largest single energy requirement is for refrigerating it at home (38%), which is larger even than the energy used for milk production and processing (34%).

Plastic bottles

High density polyethylene (HDPE) bottles are the main type of packaging for milk and are available in a number of sizes ranging from 1 to 6 pints.

They are normally a single layer of plastic with an integral handle. For pasteurised milk, the bottles are made from natural colour, translucent HDPE. A 4 pint bottle costs 8p.

A white pigment is added to the HDPE to provide a barrier to light for ESL milk. It also differentiates it from pasteurised and gives the impression of a premium product. HDPE bottles for UHT milk are usually white though the bottle is made of three layers with a black layer in the middle.

The bottles have to be sufficiently strong to be able to be filled on lines that operating at 200 to 300 bottles a minute. Even so, they have been light weighted by 10% in the last decade. After filling, an HDPE cap with a laminated foil/PE seal is applied to prevent leakage and provide tamper evidence. These typically weigh about 2g.

Polyethylene terephthalate (PET) bottles, which are clear and allow the product to be seen, are occasionally used for packaging niche milk products but they are more expensive.

HDPE bottles are collected for recycling through kerbside and bring systems and recycled HDPE is used again in milk bottles – typically 10% of a bottle is from recycled material. The recycled material has to be safe in contact with food so has to be sourced from suppliers who supply full traceability of materials and processing systems that meet EU specifications.

Liquid cartons

Cartons grew in popularity as doorstep deliveries declined and before HDPE bottles were introduced. The carton is a multi-material structure made of an outer layer of polyethylene (PE) for moisture barrier, paperboard for strength and printability with an inner layer of PE which provides a moisture barrier and can be heat sealing.

This is adequate for pasteurised milk but UHT milk needs a barrier to oxygen and light so a layer of aluminium foil is sandwiched between the PE and paperboard.

Cartons have a similar weight to an equivalent-sized HDPE bottle – 26g for a two-pint container. They are not generally used for larger volumes. They cost 8p-10p for a 1 pint carton - the higher cost for cartons with the aluminium layer.

Liquid carton suppliers have recently invested heavily to support the collection of cartons for recycling. The cartons are sent to Sweden.

Glass bottles

Glass bottles are available only in one size and are typically refillable. A pint bottle costs 25p and weighs 225g. The bottles are filled on lines which operate at speeds of 250 bottles a minute.

A glass refillable bottle has to be returned and refilled at least 13 times to match the environmental performance of a one-trip container. Doorstep delivery sometimes achieves this rate of return but bottles sold from shops are seldom returned even once.

Pouches

Flexible pouches made from low density polyethylene (LDPE) are a recent introduction for pasteurised milk although they are used widely in Switzerland, Canada and South Africa. Pouches cost 7p and weigh about 6g for one-litre or two-pint packs. They are used in conjunction with a reusable jug.

Compared to other types of packaging, they require more secondary and transport packaging to protect them and consumers need to take care carrying them home.

8. SALADS

There has been rapid growth in the consumption of fresh salad products and ready-to-eat prepared salad. This has been driven by a desire for healthier eating, the convenience of ready-prepared products and by the increase in people living alone or eating alone.

To make a mixed leaf salad for one person would mean buying 4 or 5 different whole heads of lettuce, using a few of the leaves from each and repeating this for several days, or having to throw the rest away.

Over 1.5 million tonnes of fresh fruit and vegetables are wasted every year due to damage in the supply chain or because they over-ripen in the supply chain or at home. Of this, over 50,000 tonnes are salad products.

A mixed leaf salad, prepared at a central packing house and packed in a MAP (modified atmosphere packaging) bag provides one or two portions. It is usually on the retail shelves within 24-72 hours of being picked. They are convenient and there are no outer leaves or stems to throw away in the home. Bags of salad now account for 20% of salad products sold in the UK.

MAP is effective because, after picking, fresh produce continues to respire (absorb oxygen and release carbon dioxide) and generates ethylene which promotes ripening. MAP reduces respiration, slows down oxidation, ripening and softening, and prevents product discoloration and growth of microbes. It also controls humidity in the pack and retains nutritional value.

Did you know that some vegetables are packed in bags with tiny micro-perforations to allow them to breathe and so keep fresh longer – especially useful for spinach which is a fast breather?

The bags are flushed with gas on the packing line with a blend of gases chosen to suit the product. Lettuce, for example, needs a blend typically of 5% oxygen, 5%-20% carbon dioxide and the rest nitrogen. These gases also create a pillow effect within the bag which protects the leaves from physical damage during distribution.

CAP (controlled atmosphere packaging) is sometimes used instead of MAP. The salad is packed under normal atmospheric gas conditions or with a gas flush in a 'micro-perforated' bag with tiny holes in it. The size and number of the micro-perforations is chosen according to the vegetables being packed.

The holes allow oxygen to flow into the bag and carbon dioxide to flow out and so control the balance of gases within the bag. It is particularly useful for extending the life of vegetables like spinach which has a fast respiration rate.

MAP and CAP extend the shelf life of salads to 5-8 days compared with 2-4 days for loose heads of salad leaves, and reduce waste in the supply chain and at home.

In addition, outer leaves removed at the central packinghouse are often used in other products whereas when generated at home they are usually thrown away or composted.

Bags

The material for the bags depends on whether a barrier or micro-perforated film is required and the film structure may be single or multiple layers depending on the specific requirements of the product.

Typical materials used are polypropylene (PP), polyethylene terephthalate (PET) and polyethylene (PE) and film thickness ranges between 22microns and 45microns. The film material and structure must ensure a good seal on the bag to maintain the required atmosphere.

It is usual to apply an anti-mist or anti-fog coating to the film to reduce misting caused by condensation within the bag and allow the product to be seen.

There are a number of new developments aimed at further extending shelf life, including additives to the film that absorb ethylene produced during respiration and antibacterial/antimicrobial agents that reduce bacterial growth.

9. SKINCARE PRODUCTS

The UK market for skincare products was worth £2 billion in 2009 with facial products making up over 30%. Skincare products accounted for over a quarter of all sales of toiletries.

Market growth has been stimulated by the introduction of anti-ageing products, increased demand for men's products, and demand for high-quality, high-value gifts. The packaging has to respond to these demands and demonstrate and even enhance the value of the contents.

The most common types of packaging are jars, tubes and airless pumps for creams, gel and lotions, and bottles or tottles (a cross between a tube and a bottle) with pumps and sprays for liquid products. Choice of packaging is based on the product's characteristics and the preferred method of application.

Factors taken into account for the packaging include protection of and compatibility with the product, clarity, opacity or translucence, colour, weight and decoration, as well as the filling technologies available and how the product will be merchandised. Some products may be used in very small quantities over a long period so the packaging has to continue to provide protection until it is empty.

Consumers often view skincare products as premium – or even luxury – products. They are also influenced by the weight and "feel" of the pack. As a result, care must be taken when the weight of a pack is reduced so that consumers do not perceive it as a reduction in product quality.

Jars

Jars are the traditional packaging for creams, gels and some lotions. Both glass and plastic jars are used. Glass jars are usually clear although more expensive opal or coloured glass is used for speciality brands.

Plastic jars are sometimes made from specialised polymers such as polymethylmethacrylate (PMMA) and a copolymer of cyclohexanedimethanol (CHDM) and purified terephthalate acid (PTA). Polyethylene terephthalate (PET) and polypropylene (PP) are also used. PP is less expensive than the other plastics but it does not mould so well.

After filling, jars are usually sealed with a foil laminate to prevent evaporation of the product and then capped with a plastic cap based on PP, acrylonitrile butadiene styrene (ABS) for a lightweight, rigid cap or styrene acrylonitrile (SAN) where there must be resistance to stress cracking. Caps can be moulded in either one or two pieces.

All local authorities provide recycling collections for glass containers. However, plastics skincare jars are rarely collected due to their light weight and the variety of different plastics from which they are made.

Did you know that the weight and 'feel' of a skincare product's container influence consumers' views on its quality?

Tubes

Tubes are lightweight and easy to empty. They are made from a specific type and grade of a single layer of polyethylene (PE) determined by the characteristics of the product.

Products that dry out quickly need more protection which is provided by multi-layer materials made up of a core barrier layer of ethylene vinyl alcohol (EVOH) sandwiched between layers of another polymer such as PE.

There is often a head space at the top of the tube because some products settle after filling. Snap-on or screw caps are added before filling and the tube is filled through the open end of the tube, which is then sealed. Some tubes are designed to stand on the cap, which allows better drainage of the product.

Tubes can be clear, translucent or opaque and are very light– typically 12.5g (plus a 9g flip top closure) for 150 ml of product

Tubes are seldom collected for recycling.

Pumps

Airless pumps are becoming more popular because the product is easy to apply. They are also used for specialised products that are adversely affected by air, especially those that contain expensive ingredients. Airless pumps are also easier than some packs to empty completely so there is less product waste.

The materials used to make a pump are chosen depending on the physical properties of the product, particularly its viscosity. The barrel of the pump is usually SAN (styrene acrylonitrile) or PP, though aluminium is used for products which require high protection because it provides more of a barrier. The pump's piston is usually made from PP. Pumps weigh more than tubes - 32.5g for 50ml of contents - and the cost is also relatively high at around 30-50 pence.

Normal (non-airless) pumps and sprays are used for products that are less adversely affected by air. They are convenient, easy to us, less expensive than airless pumps and are usually made from PP.

Bottles and 'tottles'

These are used for liquids. Bottles stand on their base whereas tottles stand on their caps. Glass or plastics can be used for bottles; tottles are generally plastic. Most of the same technical considerations apply when selecting the material for a specific product. PET is the most widely used plastic because it has good barrier properties and good clarity although PP, PE and PVC are also used.

Cartons

Jars, tubes, bottles or pumps are sometimes packed in outer boxes or cartons. They often have tamper evident features and provide additional protection. Cartons are usually made from premium virgin cartonboard for superior whiteness and printability. Occasionally, metallised board will be used for additional shelf impact.

10. SOUP

The UK market for soup was worth £511 million in 2009 – an increase of more than 12% since 2004. This growth was largely due to new types of packaging which have enabled better protection for a wider range of ingredients.

There are three main types of soup: liquid ambient sold mainly in cans; fresh chilled liquid soup sold in cartons, pouches and tubs (which accounts for about a quarter of all sales); and dry/powder soups sold in sachets.

Fresh chilled soups are gaining market share.

They have a healthy high-quality image and taste like home-prepared soups without the chore of preparation.

Soup pack sizes are generally designed to contain up to two serving portions although some single-serve options exist.

All liquid soups can be emptied into a saucepan and heated on the hob or emptied into a mug and microwaved. Soups in pouches, tubs and liquid cartons can usually be microwaved in the pack.

Cans

Soup in cans is stored under ambient conditions. Can bodies are made of steel, lined on the inside with lacquers approved for food contact to prevent interaction between the soup and the steel.

Can ends are made from steel sometimes with an easy-opening ring pull.

A standard can with easy-open end and a 400g capacity weighs about 54g. This is one-third less than 20 years ago.

While the can is heavier than other pack formats, its strength enables less secondary packaging to be used to protect it in the supply chain. Its

robustness also enables filling lines to operate at high speeds of over 300 cans a minute.

After filling and sealing, the soup is cooked in the can to kill any micro-organisms. This means that no preservatives are needed even though shelf life may be up to three years.

Cans are relatively expensive at 16p. They are widely recycled.

Cartons

Cartons are the most common type of packaging for fresh chilled soups.

They are generally a laminate structure with an outside layer of paperboard to provide strength, a light barrier and good printability and a layer of ethylene vinyl alcohol (EVOH), which acts as an oxygen barrier, sandwiched between two layers of polyethylene (PE), which provide a moisture barrier and allow heat sealing of the pack after filling.

Sometimes the EVOH layer is replaced by a layer of aluminium foil which has better barrier properties but the pack then cannot be microwaved. If these packs are hot filled, they have a shelf life of 28 days; if cold filled 14 days. In both cases, the soup must be kept refrigerated. If the filled pack is retorted (cooked) the shelf life increases to as much as 12 months under ambient conditions.

A carton containing 600g of soup for a two-person serving typically weighs 22g; a carton for a 300g single serving weighs 18g. Cartons cost 8-10p.

Pouches

Light weight pouches are increasingly used for fresh chilled soups. Short-shelf-life pouches use a single layer of either polypropylene (PP) or polyethylene terephthalate (PET) film.

Longer-shelf-life pouches use a more complex laminate structure made from an outer layer of nylon for toughness and printability, an EVOH or aluminium foil middle layer, which acts as an oxygen barrier, and a PP inner layer for food contact and to allow heat sealing of the pouch. If the soup is to be microwaved in the pack, aluminium cannot be used.

Pouches are the lightest pack format for liquid soups – a pouch pack for a two-person serving weighs 12g. Pouches cost around 10-12p.

After filling and sealing, pouches may be cooked to give a shelf life of 12 months under ambient conditions. If not, the shelf life of the soup will be between 14-28 days under chilled conditions.

Tubs

Tubs have been introduced recently and are growing in popularity for fresh chilled soups. Soup in tubs can be microwaved directly or heated in a different container on the hob or in the microwave.

Tubs and lids are moulded from PP and the lid often has a tamper evident feature.

Typically, soup is hot filled into the tub, which is then sealed and chilled giving a shelf life of around 26 days.

The tub and lid for a 365 ml single serve of soup weigh about 19g – similar to a liquid carton. A tub and its lid costs between 8.5p and 13p.

Sachets/packets

Dry/powder soups packed in sachets or packets have been around for many years. The dry soup is emptied into a mug and mixed

with hot water. They have a very small market share. The sachets are a laminate of paper, aluminium foil and polyethylene to provide printability, barrier and sealing.

Sachets usually contain sufficient dry soup for a single serving. These are packed in cartons as multi-serve packs. Total pack weight per serving is very low as no liquid is contained in the pack. Each sachet weighs 2.5g and the outer carton (containing 5 sachets) weighs 17g. Packaging weight per serving is 5.9g.

11. TOOTHPASTE

Toothpaste packaging protects the product and provides a convenient means for the user to dispense the toothpaste.

Its main role is to provide protection for the active ingredients in the formulation. Toothpaste is used by consumers in every part of the world and every climate in the world. This requires the packaging to survive the manufacturing, distribution, retailing and consumer use environments for the global community. Extreme temperatures, humidity, impacts, vibration and compression are all conditions and hazards that the packaging must survive. A toothpaste tube is often dropped on the floor and used in the shower and yet, it still maintains a safe and healthy seal for continued use.

How toothpaste is dispensed varies throughout the world. In many markets accommodate the purchasing needs of the consumer. Gels are often sold in pumps.

Brands use bright metallic designs and high quality printing on tubes and cartons as well as embossing and holographic printing on cartons to better establish the high value of the product.

Do you know why toothpaste is sold in tubes?

instances, people use their finger to brush their teeth. For children, dispensing toothpaste on a brush is a challenge. The packaging has to be designed to allow whatever method of dispensing is required and ensure that all the toothpaste can be emptied from it.

Oral care products come in different forms; powder, paste and gel. In emerging markets powder is often sold in a tin can and paste is sold in sachets. Sachets in emerging markets accommodate the purchasing needs of the consumer. Gels are often sold in pumps.

Graphics also help consumers select the type of toothpaste that best suits there needs.

Originally, toothpaste was sold in jars but the collapsible tin and lead tube introduced in the 1890s quickly replaced jars. An American manufacturer had the idea after his son travelled to Paris and saw painters using paint from tubes.

In 1896 Colgate started using collapsible tubes. Polyethylene/aluminium laminate tubes entered the market in the 1940s during World War II when there was a metal shortage. Pumps were introduced in the 1980s. Currently the light weight stand up laminate tube introduced to the market in the 1990s leads the market.

Outer boxes (known as cartons) are usually used both to protect the tubes during distribution and to provide stability and protection on the retail shelf. The carton and tube work together as a system to protect the product. Cartons typically weigh 14.5 g for a 100 ml tube. Trials with cartonless tubes have generally failed to gain consumer acceptance except for the short tubes used for children.

Over the years the energy and material used for the tube has been significantly reduced, aided by use of the carton which provides the required protection during distribution.

Multilayer tubes

Some tubes are designed to be stored lying down, others stand up on the closure. Stand up are all plastic laminates with an EVOH barrier. They are designed to stand up throughout their life. Aluminium barrier tubes have a ‘dead-fold’ that creates a flattened shape, which means that as the tube is emptied, it cannot stand up.

Multilayer tubes are typically a 7 layer laminate structure of polyethylene with a barrier layer of either EVOH or aluminium which provides a protective barrier for the toothpaste, prevents it drying and retains flavour. The tubes have a polypropylene cap which weighs 2g-5g.

Typically 100 ml of toothpaste are contained in a 7g tube.

Tubes are rarely collected by local authorities for recycling. They are technically difficult to recycle due to their mixed material structure, and, in common with other lightweight packaging, the logistics of collecting and storing sufficient tubes to justify spending energy to recycle them are challenging – to get just 1 tonne of material means collecting 150,000 tubes. In areas where local authorities use energy from waste facilities, energy is recovered.

Aluminium collapsible tubes

Aluminium collapsible tubes are in decline as consumers prefer tubes which do not dent, crease and split or become misshapen during use.

Aluminium tubes are relatively light and malleable and have excellent barrier properties to protect the contents against moisture and flavour loss. They usually have a small diameter polypropylene cap to reclose the tube. A tube to contain 75 ml of toothpaste weighs about 8g with the cap weighing about 2g.

Technically, the all aluminium collapsible tube is recyclable but they are rarely collected.

Pumps

Pumps provide an alternative to tubes. They deliver a measured amount of toothpaste. However, they have a small and declining share of the market, as they are more expensive than other pack forms.

Pumps are generally injection moulded from polypropylene components. They have a thick wall section to provide a barrier to protect the contents from drying out or flavour loss and are relatively heavy – a 100 ml pack typically weighs 33g. However, they do not need cartons for protection during distribution or for retail shelf presence.

12. YOGURT

Over 90% of UK households buy yogurt. An average person eats 200ml of yogurt a week. Most people buy it for its perceived dietary and nutritional benefits and it is seen as both a healthy dessert and a snack food.

"Spoonable" yogurts accounted for 70% of the new products launched in 2009, with drinkable yogurts (usually for children's snacks and functional drinks) making up most of the balance.

Yogurts require chilled storage at home and typically have a shelf life of around 28 days. Single pots and multipacks have similar market shares although single pots are increasingly popular.

Plastic pots

Most yogurts are packed in thin-walled plastic pots made from polystyrene (PS), polypropylene (PP) or amorphous polyethylene terephthalate (APET), which may have a recycled content (rPET). Each polymer has different properties so provide different characteristics to the pot. PS allows a snap feature to separate a single pot from a multipack and tends to be the least expensive at 1.3p per pot; PP allows individual packs to be folded to enable the contents from dual chambers to be mixed without the pot breaking. Pots costs 1.5p. PET pots perform similarly to PP pots but tend to be more expensive.

Did you know that PS breaks easily so is used for snap pots; PP is bendable and won't snap so is used for single pots.

The packaging manufacturer usually provides the yogurt manufacturer with reels of plastic film from which pots are formed and filled. After filling, the pots are lidded. The lids have to provide a barrier to moisture, be capable of being heat-sealed onto the pots and provide a good surface for printing. Aluminium foil/polyethylene (PE) combinations were used for the lids but these have now largely been replaced by less expensive all-polymer lids of PP, PET, PP/PE and PET/PE. Lids are usually printed; the pots may be undecorated, labelled or printed.

Single pots are normally sold from shelf-ready trays. Multipacks may be grouped together, with plastic film or a card sleeve to make them easier for the consumer to handle. A wide range of product sizes are available – 50-85g for children's packs, larger single pots of 100-165g and 500g multiple portion pots. The pots themselves are very light – 4.8g for 125g of yogurt and are typically 20% lighter than they were 20 years ago.

Plastic yogurt pots are rarely collected for recycling. The lightweight nature of the pots, the yogurt residues in the pots – which may weigh more than the pots themselves – and the variety of polymers used, does not justify spending energy to recycle them.

Paper-based pots

These pots are often used for premium yogurts because the paper provides an excellent surface for the high-quality printing desired on premium products.

The sides and base of the pot are generally paperboard – which provides strength – with an inner layer of PE, which provides a moisture barrier and allows the lid to be heat-sealed to the pot. The pots are usually made by a packaging manufacturer and transported to the filler who fills and seals them with lidding film.

Single pots typically contain 150g of yogurt and multiple-serve packs contain 500g. Single pots are more expensive (3-4p) than the all-plastic pots. They are also heavier weighing around 6g for a pot containing 150g of yoghurt. Paper-based yoghurt pots can theoretically be recycled together with other paper and board packaging. There is not enough PE film to pose a technical problem. However, as with the all-plastic pots, yoghurt residues make recycling expensive and few local authorities actively encourage the public to put these containers into collection systems for recyclables.

Other

Glass pots are primarily used for premium products. Other types of packaging and designs have a small market share. These include blow moulded PET fruit-shaped squeezable packs for children and flexible pouches with tear-off spouts.

As the market expands and blurs between yoghurts, fromage frais, smoothies and other forms of milk-based drinks, new packaging formats are being developed.

SUMMARY

In the days before supermarkets, packaging still existed. It was designed in line with demands of the supply chain and legislation of the time. Some products, such as bacon, cheese, rice and flour were shipped in bulk to grocery stores where the grocer weighed quantities and put them into relatively simple packages. Early consumer packaging was much heavier and bulkier than modern equivalents.

Modern society has different and more complex needs than those which existed 50 years ago – including global sourcing and meeting strict government regulations - and if modern packaging and packaging systems did not exist, today's consumers would have less choice of products to buy and higher product costs.

Choosing packaging

The characteristics of a product play a key role in the selection of its packaging – packaging does not exist without a product. Factors taken into account include:

- The physical nature and properties of the product
- Quantities of product in the pack to meet consumer needs
- How the consumer will store and use the product
- Required shelf life, both in the retail store and at home
- Protection of the product throughout the supply chain, including production, distribution, storage and merchandising
- Processing and pack filling systems and the costs of each option
- Relative costs of various pack formats
- Material options e.g. paper/board, plastic, glass, metal or mixed-material structures
- Presentation
- Storage conditions during transit, in the shops and at home i.e. ambient or chilled/frozen
- Openability and re-close ability of pack
- Tamper evidence
- Child resistance
- Ability of pack format to accommodate information related to the product, such as bar coding, best before date, nutritional information, how to prepare/use and related to the package, such as anti-littering or recycling information.

Typically the energy used to make packaging is 8% of the total energy used to produce and deliver all the products that we buy. So a small amount of materials and energy used to make packaging protects a large investment of materials, energy, water, time and money in the products.

The often negative image of packaging fails to recognise the essential contribution that it makes to our modern lifestyle and exaggerates its environmental impact. Attention is usually focused on the waste generated by used sales packaging and ignores the fact that packaging:

- protects far more resources than it uses
- prevents far more waste than it generates
- reduces overall waste.

Waste reduction

No material or type of packaging has a monopoly of environmental virtues. All have pros and cons and the most important consideration is how well it does its job.

Take milk for example. The energy to provide one person's weekly supply of milk is 38 MegaJoules (MJ), the packaging to protect it is on average 4.4MJ (across all types of packaging).

This means that the difference in energy between pack types is a small fraction of the energy used to produce the milk. Up to 25% of milk gets wasted, usually because people buy more than they use. If even 15% of milk gets thrown away at home, this wastes 5.7MJ a week. In addition, some will go to waste in the supply chain.

A comparison of two types of packaging for milk shows the pros and cons of each. Plastic milk bottles typically weigh 30g for a litre of milk; pouches weigh 6g. Bottles are widely collected for recycling, pouches are not.

However, even if an 80% recycling rate could be achieved for the bottles (an ambitious assumption), then 6g would still be generated as waste ie the same amount of material as the pouch with no recycling. And the recycling process of collecting, sorting, cleaning has its own negative environmental impact which has to be offset against any gain from the material recovered.

Whether a pack can be recycled or not is not a good basis for determining its effectiveness from an environmental perspective. More milk is likely to go to waste when packed in pouches than bottles, because pouches are more fragile. Consumers therefore should choose the right amount of milk in whatever sort of packaging suits their lifestyles so that the milk doesn't get wasted. A similar argument can be used for other products.

Recovery of used packaging

In the supply chain, the weight of packaging and whether it is degradable, inert, recyclable or recoverable is of secondary importance compared with its role in ensuring safe delivery of products from point of production to the end user.

After the product has been used, packaging becomes a potential secondary material or source of energy. At this point, its weight only becomes relevant because materials need to arise in relatively large, homogenous quantities to justify investing resources to 'mine' them. A prospector always looks for the thickest seams of primary ore.

Sea water contains gold but in such small quantities that it is not worth trying to extract it. The same principle applies to used packaging.

Used packaging which is generated from industrial and commercial sources is relatively easy to recover and recycle without expending significantly more resources in collecting, sorting and cleaning because it arises in substantial quantities of relatively clean, easily separated materials – corrugated boxes or pallet wrap for example.

Packaging that is generated by the 25 million UK households is a heterogeneous collection of comparatively tiny amounts of material. The challenge is to manage it in such a way that secondary materials can be recovered with a net environmental benefit.

On average, households in the UK generate 23kg of rubbish each week of which 4kg (18%) is used packaging. Over 60% of all the used packaging (from households and industry) is recycled. Recycling rates have increased each year thanks to local councils expanding their collection programmes. In many situations, recycling is the environmentally-preferred recovery option for used packaging from households. But where the used packaging is a mix of different packaging materials, is very light and/or contaminated by food or other product residues, energy recovery may be the better environmental option.

Conclusion

Packaging is a controllable cost for most product manufacturers. They seek to minimise such costs through optimising and minimising the amount of packaging used without compromising the ability of the package to perform its functions.

Effective packaging plays a vital role in reducing product waste and all the related environmental damage inherent in such waste. It ensures that a new washing machine arrives undamaged; it ensures that a cucumber is edible for several days. By reducing product waste, packaging makes a substantial contribution to waste prevention and helps society move towards a low carbon economy.

GLOSSARY

Ambient temperature

The temperature of the surroundings - so is usually the room temperature.

Energy from waste

The process of generating and utilising energy in the form of electricity and heat from the incineration of combustible wastes. The process recovers some of the energy contained within the waste including paper, board and plastics. Recyclable items are removed from the waste stream and the remaining waste is burned under carefully controlled and highly regulated conditions. The heat generated is used to generate electricity as well as sometimes providing heat for local use.

This technology has been widely used for decades to complement and supplement recycling initiatives in Switzerland, Germany, Denmark and most other countries in continental Europe. It is now being used increasingly in the UK to minimise the amount of waste sent to landfill and to provide electricity.

Laminates

Laminated packaging is formed by uniting two or more layers of packaging material together, with each layer having different properties which when combined, provide the required protection to the pack contents. For example, different materials may impart strength, toughness or a light, moisture or oxygen barrier to the pack or enhance the sealability or printability of the pack.

Lightweighting

Lightweighting is the process of reducing the weight of packaging. It may be achieved by reducing the thickness of the packaging – often possible because of improvements in material characteristics or by the use of improved manufacturing technologies. Alternatively, redesigning the shape and form of the package may help reduce its weight.

Reducing the amount of material is often the most effective and efficient way of reducing its environmental impact as long as there is no loss in its role of protecting the contents of the pack. Lighter weight packaging means that fewer resources are used in its manufacture and more product can be loaded onto a lorry for distribution so fewer lorries are needed.

Modified atmosphere packaging (MAP)

This is normally used to extend the shelf life of foods such as meat and salads by slowing down the rate at which the product deteriorates. MAP reduces the wastage of food both in the retail store and at home. The packs are usually laminates which are filled with blends of atmospheric gases (oxygen, carbon dioxide, nitrogen) which delay the onset of deterioration, with the ratio of gases being carefully selected depending on the type of food being packed.

Moulding

Moulding is a process which converts materials into a final form by means of the controlled application of heat and pressure in purpose built machinery. The hot, fluidised material is injected into a die cavity shaped in the form of the intended product. In plastics moulding, there are several different techniques including blow moulding, extrusion and thermoforming, and injection moulding.

Multi-material packaging

Packaging that consists of layers of different materials which together provide all the desired functional properties of the pack – strength, sealability, oxygen, moisture or light barrier, printability for example. A pack of ground coffee consisting of thin layers of plastics and aluminium is a typical example of multi-material packaging.

Multi-packs

Several individual sales items grouped into one pack for ease of transport and handling. Examples are packs of 6 or 8 individual yoghurt pots grouped together either by plastic film or sheets of cardboard.

Packaging types

Primary packaging is the packaging which contains the product which is packaged for sale – hence it is often referred to as sales packaging. Typical examples are bottles, jars, tubes, trays, bags.

Secondary packaging encloses and can provide added protection to the primary packaging e.g. the box used to contain a tube of toothpaste. It can also be used to combine several sales units together into one unit, when it can be referred to as grouping packaging e.g. six or eight packs of yoghurt.

Tertiary packaging – often called transport packaging – is the outer packaging used to protect packaged products on their journey through the distribution chain. Cardboard boxes, pallet film wrap and pallets fall into this category.

Polymers

Polymers are materials usually derived from by-products of the oil and gas refining industry whose main purpose is to produce fuels and oils for transport and heating. These by-products account for 4% of all the oil and gas produced. They are used to make polymers for packaging, medical devices, building and construction products, vehicles, and electrical and electronic products. To make the polymers useful for such diverse applications, a variety of additives may be mixed with them e.g. colours, softeners, anti-oxidants and ultraviolet inhibitors. At that point the products are commonly referred to as ‘plastics’.

The polymers most commonly used to manufacture plastics packaging are polyethylene (high density - HDPE - and low density - LDPE), polypropylene (PP), polyethylene terephthalate (PET), and polystyrene (PS). Each polymer has different technical properties so they are chosen to provide exactly the protection needed by specific products. For example:

- HDPE for milk bottles
- LDPE for carrier bags-for-life and pallet wrap
- PET for bottles for soft drinks, some food trays and some film applications
- PP for food trays and film
- PS for food trays and yoghurt pots.

There are a number of other polymers that are used in more specialised applications.

There are also polymers that are derived from agricultural products rather than from oil and gas. Popularly known as bioplastics, these have different properties but currently tend to be more expensive than conventional polymers.

Recycled content

The amount of recycled material used to replace virgin (prime) material in packaging. The recycled material may be derived from used packaging or from other (non-packaging) applications.

Recycled material is widely used in a number of packaging materials. Cardboard boxes usually contain 80% or more of recycled content; metal cans and glass jars/bottles typically have 30-50% recycled content; plastic milk bottles have 10-20% recycled content.

Recycled paper and board is typically not used in contact with food unless its quality and source can be guaranteed. The use of recycled plastics in packaging food and drink has to meet stringent regulatory requirements to ensure that it removes any possible contamination which could pose a threat to health. Metals and glass are reprocessed in furnaces operating at very high temperatures so any possible contaminants are destroyed during reprocessing.

Recycling

Recycling of packaging is a process which includes four steps:

- Collection - used packaging is collected from households or from industry or commerce
- Sorting - the different materials are sorted – automatically, mechanically or by hand into separate streams and then baled. At this stage, metals may be further sorted into steel and aluminium and plastics into different polymers.
- Reprocessing - the material is sent to a reprocessing plant where it may be cleaned, prepared and made suitable for second life applications. The reprocessing technologies used for each material stream are very different and specific to that material stream.
- Reuse - the reprocessed material is used to make a new end product. For some materials this step may occur at the same plant where reprocessing is done. If the new product is another packaging product, this is known as ‘closed loop’ recycling; if the new product is a non-packaging product, then this is known as ‘open loop recycling’. Both types of recycling are valid ways of conserving resources.

NB Plastics recycling faces the additional challenge that there are several different polymers used to manufacture a plastics product. Because each polymer has different technical characteristics, they must be separated from each other at the sorting stage before being sent for reprocessing – mixed polymers have limited value in second life applications.

Shelf life

This is the length of time which a packaged, perishable product such as food, drink, medicines is given before being considered unsuitable for sale, use or consumption. Many perishable goods carry a ‘best before’ date on the label. A product which has passed its shelf life date may still be safe to use/consume but its quality is no longer guaranteed.

Vertical form fill seal bags

These are bags normally made on automated equipment from a roll of plastic film or laminate and filled at the same time with the product and then sealed. Both solids and liquids can be packed in this way.

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