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Brow Packaging Environmental Product Guide

A guide to current packaging, the recovery of resultant waste streams and terminology used for the various waste streams and ongoing environmental packaging innovations

Current Main Stream Packaging

This is intended to give a high-level overview of the main raw materials used as a base in every day to day packaging.

Plastic Packaging

Plastics are traditionally produced from oil and gas that originated from forests and vegetation which decayed millions of years ago, broken down by pressure over millions of years into organic carbon products. They are not seen as a sustainable resource.

Plastics start their life when crude oil is heated under pressure to produce various lighter oils (naptha) and gases (e.g. ethane gas). These gases in turn are converted into various solid plastic products, using a mixture of pressure and catalysts, to make plastic in its raw material form, usually as pellets. These pellets are then used to make plastic film, injected-molded plastic parts or sheets of plastic for thermoforming into various shapes.

There are many types of plastic with differing properties:

Polythene is made from ethylene gas (C2) which is turned into a solid in high pressure vessels. Ethylene gas is also used to ripen bananas!
We use polythene to make film products, other companies may use variants of it to blow plastic milk bottles.

Polypropylene is made from propylene gas. It is a harder plastic. It can be used to make thin, clear packaging films. We sell polypropylene films and polypropylene based food trays.

There are many other types of plastic used to make plastic trays, for example APET or Polystyrene.

Plastics are light weight, versatile and use a fraction of the resources during their manufacturing process compared to many other packaging products. The production processes are efficient and the bulk polymers can be shipped in efficient units.

The negative is that plastics and films will degrade over many years and to date the recycling infrastructure has been weak. If dumped in landfill or the oceans, it will take years to breakdown and may become micro plastics as they are broken down into smaller parts.

The answer is to recycle but each plastic has different properties which means for recycling to work, each plastic must be sorted into its own waste stream. In addition, for recycling to work there must be an end market for the reclaimed material. Failing that, the mixed waste may have to be recovered to be used as a feedstock or to make energy.

Cardboard & Paper

Paper and cardboard products are made from wood fiber (cellulose) so will biodegrade much more quickly if placed in landfill.

These products tend to be bulkier and use more resources than plastics but are be seen a more sustainable resource.Large areas of trees are grown & harvested, which are then delivered to large processing plants (mills) to breakdown the fiber to make products such as corrugated board and paper. This process involves physical and chemical processing to break the fibers down, and can include a bleaching process to make paper, which is not environmentally friendly.

Compared to plastic, a paper packaging product on average, will require many more times the weight of plastic to perform the same packaging role so much more resources will be required. The packaging is heavy and bulky so will require more transport to get it to market and will take up greater volumes.

Packaging can consist of cardboard food trays, paper cups, corrugated packaging and various types of wrapping paper.

One of the main problems on the environmental front is that in the case of food use, the food contact layer, for example the inside of a paper cup or food board tray may be coated with a thin layer of plastic to stop moisture penetration. This destroys the biodegradable nature of the product as it creates a composite material - one element breaks down, the other does not! This destroys the products environmental credentials and means recycling is impossible so either goes to landfill or is used to generate energy.

The smart money will be on inventing environmentally friendly coatings to broaden the viability of cardboard use.

Aluminium Foil

Aluminium foil packaging is produced from aluminium ignots, a metal which is produced from natural ores using a very high energy electrical-process. If this energy is hydro-generated electricity (for example in Iceland) the environmental impact is lessened.

The products made from it consist of thin packaging films, micro coatings on crisp packets which act as a gas barrier layer, to heavier foil trays formed into various shapes.

The products can be recycled but will not breakdown for many years.

Current Recycling and Recovery Hierarchy & Terminology

Current packaging products are designed, manufactured, used, recycled, recovered or become waste using the following step hierarchy.

The government has several initiatives such as landfill tax and Packaging Waste Legislation and levies to drive the sector in the way they think is best and are considering further legislation.

Renewable Sources of Packaging

Raw materials produced from renewable resources are a resource which can be used repeatedly and replaced naturally. Examples include goods or commodities such as wood, paper and leather. It is thus more desirable to use this type of resource for packaging products where it is suitable.

Oil is not a renewable source as it can't be replaced – there is a finite resource.

Reduce the resource originally used in the packaging

This should always be given prominence when designing packaging for products.
The less resource is used, the less waste will be produced when the product has served its purpose.
Thinner trays and packaging films are constantly being developed where it is possible to still protect the product.

Reuse Packaging

For packaging products this is not going to be widely used to recover packaging due to the volume of packaging product that exists. In addition, the often-hygienic requirement of packaging makes reuse non-feasible.

Recycle Packaging

This is increasingly becoming the main route to recover packaging waste.
Packaging materials must be separated into the various waste streams and can be processed back into reusable raw materials which can go back into the packaging cycle.
Think of how plastic water bottles (PET) are recycled.
The issue is it needs a large infrastructure to collect the materials, then reprocess them.
The government tries to encourage the development of this infrastructure via the PRN (Packaging Recovery Note) levy system which all users in the packaging cycle contribute to.
For this sector to grow, a market has to exist for the recycled material to be reused. This is often where the difficulty occurs – if oversupply exists and there is a low demand market for the recycled material, then low market prices will occur which means recyclers have no income and no incentive to recycle.
Some plastic manufacturers are looking at using mixed waste plastic as a feedstock to make new virgin polymer. This is in its early days.

Recover Packaging

This in the past has included shipping waste to other countries for recycle, for example China. This has recently caused chaos as China has stopped taking in certain aspects of waste paper and plastic. This for example has pushed up the demand for virgin pulp and hence paper and cardboard prices have soared around the world.

Alternatively, the waste can be used to produce energy. This can be done for example using aerobic digestors for food waste to produce gas to make energy or by directly burning waste to produce energy.

Landfill Packaging

The remaining waste after the above processes have been exhausted means waste is dumped in landfill or in some countries it is dumped in rivers or the sea.

Most waste will take many years to breakup and decompose in either landfill or the natural environment. Some waste may break down quicker than others and may be more environmentally friendly.

Hence there would be a desire to make packaging products from those materials which breakdown the quickest into natural, harmless products.

Oxo-degradable products: these products break down into smaller pieces, using mechanical stress, heat or light which in time, then bio-degrade over a longer period.

Biodegradable products: these are products capable of being decomposed by bacteria or fungi or other living organisms into inert organic natural products and thereby avoid pollution. The only negatives are that they make require certain physical conditions to breakdown – may need water, heat, humidity, light, etc, for the bacteria to work.

Compostable products: A product that is "compostable" is one that can be placed into a composition of decaying biodegradable materials, and eventually turns into a nutrient-rich material. It is almost synonymous with "biodegradable", except it is limited to solid materials and does not refer to liquids.

The time taken to degrade can verify by product. Some websites give the following examples:

Cotton rags	1-5 months
Paper	2-5 months
Rope	3-14 months
Orange peels	6 months
Wool socks	1 to 5 years
Cigarette butts	1 to 12 years
Plastic coated paper milk cartons	5 years
Leather shoes	25 to 40 years
Nylon fabric	30 to 40 years
Plastic 6-pack holder Rings	450 years
Glass bottles	1 million years
Plastic bottles	Forever ….?

It thus makes more sense to use a recycle or recovery process for some items of packaging rather than landfill those products which will take years to bio-degrade.

Ongoing "Green" Packaging Product Initiatives and what Brow Packaging offers by way of Environmental Products

Packaging films – Polythene we make

We will always try to make our packaging films fit for purpose, and as light as possible.

We have several in house recycling machines to reuse plastic polymer on site. A small element of polymer is recycled off site. (We segregate our cardboard waste and have it recycled off site into other packaging products).

When we make polythene film from conventional plastic resins, we can add certain products to speed up the decomposition of the standard plastic film and bags. These products are only suitable for certain applications, for example waste bags or carrier bags.

We can add calcium carbonate as a masterbatch to our virgin polymer to create a finished oxo-degradable film or bag product. A certain amount of exposure to mechanical stress, light or heat will cause the film to start degrading. These additives can for example be supplied by Omya or Grannic, This helps to break up the polymer chains so that the plastic film gets broken into small flakes if it is landfilled and gradually breaks up but it still may take years to then bio-degrade.

The use of these additives does encourage less use of virgin plastic polymer. These masterbatches are used in small dosages and are not expensive.
The downside is that if this film is recycled, the small amount of calcium will have degraded the original polymer so the recycled material is not as valuable or useful.

If a certificated approach is required, we can add other additives. The primary product we would use is a Symphony d2w's Controlled Life additives which are oxo-degradable additives which have an Eco Label certification.
Oxygen is required to trigger the decomposition. The additive speeds up the decomposition of the film made from conventional plastic resins into smaller particles but decomposition of these particles still takes time.

Some of our Multi-National conventional plastic (polymer) producers are looking at new ways of making polymers. Instead of using oil they are looking at using "Certified Renewables". This includes making ethylene gas from wood products being introduced into the crackers rather than oil as a feedstock.

The other methods being considered are "Chemical Recycling" whereby a "pyrolysis" process is used to convert waste plastics into feedstock to go back into the crackers to be turned into polyethylene. So far this has been on a small scale but may offer a closed loop recycling system if the economics can be justified.
Some of the leading retailers are looking to source plastic polymer from these sources as the base for the packaging they use, but the demand outstrips supply.
I would hope this takes off and becomes the way forward. If we create a market for waste plastic by turning it, via heat and pressure, into waxes which are in heavy demand as coatings which are environmentally friendly and a dense hydro carbon soup which can be shipped to refineries to act as a feedstock, it can be recycled into virgin plastic as part of the refining process - the loop will be closed in an efficient manner! Waste plastic will be sought as it will have a value and it may also be a lower energy, closed environmental loop recycling/recovery system compared to the bio polymer route noted below.

Until pyrolysis takes off, the current, most environmentally friendly film product we could make, are 100% bio-degradable based films. We would use natural polymers (bio-plastic resins) to make the film. These usually consist of substances obtained from plants such as corn starch and other renewable raw materials such as vegetable oils. They would degrade in the ground rather than be recycled and would have to be kept separate from existing plastic polymers which are recyclable. These bio polymers can only be used for certain applications as their properties are different to main stream plastic polymers.

It sounds good, but these special polymers are made in low volumes in special manufacturing plants using plant-based materials and cost at least twice the price of a conventional plastic polymer and are not as simple to process.
They also use a large amount of energy to produce, from growing the crop (wheat, potatoes, sugar cane, etc) to harvesting in large volumes, to processing, in order to produce the bio-chemical for use to make the bio polymer.
This also leads to competition for use of the land with food production and rising food prices.
Bio Polymers are usually used if legislation demands they are used (for example Italy demands carrier, waste bags and vegetable bags are made from it) and providing the finished packaging produced meets the physical requirements of its intended use.

An example of the use of these bio polymers are in the caddy bags for household food waste that go to landfill but breakdown quickly.

In the UK. Household waste bags can be made to British Standard BS EN 13592:2017 which focuses on more of the mechanical properties of bags. The environmental side is handled by European Standard EN 13432.

Industrially compostable plastics or products which are certified to EN 13432 are permitted to bear the Seedling® label from the European Bioplastics e.V. organization. It requires biodegradation of 90% of the materials in a lab within 180 days.

In the US, the standard is ASTM 6400 and it requires 60% biodegradation with 180 days for waste put in municipal and industrial aerobic composting facilities.

The OK compost (EN 13432) symbol signifies that packaging or products featuring the OK compost label are guaranteed as biodegradable in an industrial composting plant under

certain conditions. This applies to all components, inks and additives. The sole reference point for the certification programme is the harmonized EN 13432 standard: in any event any product featuring the OK compost logo complies with the requirements of the EU Packaging Directive (94/62/EEC).

TÜV AUSTRIA (formerly Vinçotte) is a certification body authorized by European Bioplastics and may award the Seedling logo to products that are in compliance with the EN 13432 standard. By awarding both the OK compost and the Seedling logo, Vinçotte's certificate holders have a way to give their compostable products recognition throughout the entire European market.

Seedling

The other main symbols you will see from certification bodies are:

Examples of the polymers which we could use in our Belfast manufacturing extrusion process to make the above certified products include:

Bio Fed resins – M.Vera® product range - made in Germany by Akro-Plastics

Bio-Flex resins – made by FKUR Kunstoff in Germany

Mater-Bi resins – made by Novamont in Italy - Mater Bi resins are used to make films and catering disposables. Italy helped drive the success of this more expensive resin by making it law for certain products to be made from it.

As these plants scale up and legislation comes into play, the use of these bio-resins will increase. These bio-resins tend to breakdown by bacteria in the soil rather than oxi-degradation of the calcium carbonate type weakened conventional plastic resins.

To put it all in perspective, for now, conventional polythene resin production is growing by millions of tons pa compared to tens of thousands of tons growth pa in the bio-polymers market.

Packaging using Thin Films – Cellulose as an Orientated Polypropylene substitute.

30 years ago, sweets used to be wrapped in cellulose wrappers. This material held the twist and easily degraded as this film was made from cellulose, a wood product.
Cellulose was also used to wrap many other products.

As newer mass-produced polypropylene resins arose, the use of cellulose resins diminished.

In the years to come, cellulose films may make a comeback as being environmentally friendly, but they are hard to source and are expensive compared to the conventional OPP films we supply.

Packaging Trays & Products – Made from Natural Bio Polymers as a plastic substitute

Some plastics instead of being derived from oil, can be generated from plant-based products. For example, a product called PLA (Polylactic Acid) can be made from the starch in corn. The final product can be thermoformed (molded) to form clear trays, just like APET plastic trays, which will then biodegrade in landfill. In the past, this has caused concern in that it means world crop production is redirected from food use to packaging, so food prices may rise. In addition, a major retailer went down this path a few years ago for their salad containers – this was not successful as the shape of their trays started to deform on the shelf.

Mater BI -catering disposable salad containers are line we stock which are bio-degradable.

Plastic Trays – use of Cardboard Trays as a plastic substitute

We are starting to see more trays being made from cardboard rather than plastic.
As developments improve, cardboard folds/inserts will help to displace plastic trays.

We are starting to supply an increasing range of such trays with windows. While polypropylene based windows in kraft cardboard trays are not recyclable, several of our newer products have a bio-degradable windows made from either cellulose or PLA material.

We continue to stock a growing range of board trays. You will find these in our product catalogue under the Kraft & Echo Friendly Product Range listing and in other product groups.

Other Paper & Natural Products

We stock a wide range of renewably sourced products which will continue to grow.

Some of them have limitations in that the current coatings they contain, often a thin layer of plastic, restrict their recyclability. These coatings are necessary to make the product suitable for food packaging-the coating usually applies to the inner food contact surface and involves the application of an inert food grade barrier layer to prevent moisture ingress or contamination from fibers in the board.

There are moves in the packaging industry to develop coatings from bio sources rather than plastic. This will mean that Kraft Paper cups for example and lined cardboard trays will become recyclable and or compostable as plastic linings will be phased out.

Summary

We, Brow Packaging will continue to increase our range of environmental, friendly packaging products.

Customers can ask our production team about the viability of bio-resins but in the interim, until volumes grow across the world, these will remain expensive products and their uptake will primarily be driven via legislation or necessity.

Our stocked packaging environmental product range will grow as new production processes come on stream around the world and for example, as coatings are developed which help expand the use of cardboard related products.

As a packaging provider, we will continue to try and provide you, the user, with honest data so that you can be aware of the various components of your packaging so that you can access your environmental stance.

We hope this guide has given you a good overview to the key issues facing packaging, its effect on the environmental and what can be done with the packaging after it has been used.

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