RECYCLING

7

KEY FACTS

Recycled fibre from waste paper and board provides approximately 50% of the fibre requirements of the paper and board industry world-wide

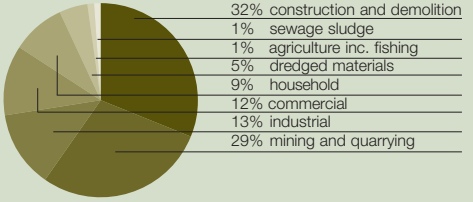
European packaging regulations stipulate the amounts of packaging waste to be recovered and recycled

Though fibres can be recycled several times, the extent to which this occurs is dependent on recovery (collection) and losses in reprocessing. Some paper and board products cannot be recovered and others are taken out of circulation in books and archives

In Europe, recovered paper and board is graded to reflect its recycling value

WASTE IN THE UK

Estimated total annual waste arising by sector 2004: total 335m tonnes



Sources: DEFRA, ODPM, Environment Agency, Water UK

Definition and importance of recycling and fibre quality

What is meant by "recycling"?
Recycling occurs when a product having completed its original function is reprocessed to convert it into useful new material.

When folding cartons are discarded after use they become part of the packaging waste stream. They can be recycled by reprocessing whereby the fibres are separated. The recovered fibre is then used to make cartonboard or another paper or board product. Alternatively, they can either be composted, a process also known as "organic recycling", or their energy content can be recovered in an energy-from-waste incinerator.

For recycling to happen, the packaging waste must be recovered, i.e. collected and sent to a mill. Waste arising during manufacture is relatively easy to recover, such as trimmed waste in cartonboard mills and from carton manufacturers. However, the bulk of cartonboard, along with all paper and board products, is ultimately dispersed throughout society and an infrastructure is required for its recovery. It may be segregated in the home, or other point of disposal, and either collected or taken to a collecting location.

The paper and board industry has always had a recovery infrastructure and the recycling of paper and board predates the modern industrial era. Before the use of wood as a raw material the main cellulose based raw material for hundreds of years was obtained by recycling fibres from discarded linen (flax fibre).

How important is recycling in the paper and board industry?
Recovered fibre, including fibre from recovered paper and board packaging, contributes nearly 50% of the total fibre used in the paper and board industry world-wide. The amount of recovered fibre used is around 150 million tonnes per annum. Used packaging including folding cartons and corrugated board, is not therefore the only source of fibre for recycling in Europe. Other major sources include newsprint and magazines, office stationery and general paper waste from printers.

Rates for the recovery and recycling of packaging in Europe, including that from paper and board based packaging, are set by the European Commission, as required by the Directive on Packaging and Packaging Waste, 94/62/EC.

Is all recovered fibre of equal quality?
The quality of recovered fibre depends on a number of factors:

- whether they are long or short fibres
- how they were separated from the original wood
- whether they were bleached
- to what extent are they associated with other materials such as coatings, ink, plastics, wet strength resins and adhesives

Fibre quality therefore depends on the initial separation and treatment, how they were made into paper or board and, finally, how those products were used.

The quality of fibre ranges from virgin pulp substitute (unprinted white trimmings), office waste, newsprint, brown (unbleached) packaging to mixed papers and boards. The grade or type of waste and market demand determines the price.

Recovered paper and board is therefore graded. A list of defined grades has been agreed between CEPI and BIR.

This list was published in 1999 and it describes 57 grades of recovered paper and board, including several cartonboard grades. It differentiates in terms of the type of cartonboard, which takes into account the fibre composition and the extent of the print coverage.

WHAT DOES HOUSEHOLD WASTE CONSIST OF?

23% Garden waste
Grass cuttings, leaves, hedge clippings and soil

18% Paper and cardboard
Boxes, drinks cartons, paper bags, newspapers, magazines and mail

17% Kitchen waste
Vegetable peelings, leftover food

9% General household sweepings
Dust, fluff and cigarette ash

8% Plastic
Plastic drinks bottles, food containers and clingfilm

7% Glass
Bottles and jars

5% Scrap metal
Old electrical equipment, batteries

5% Wood
Old furniture, fencing, DIY offcuts

3% Textiles
Old clothes and rags

3% Metal packaging
Tin cans and aluminium foil

2% Nappies

Source: The Waste and Resources Action Programme

Can the fibres be recycled indefinitely?

In technical terms the number of times a fibre can be recycled depends on the original virgin fibre, its initial processing and use, and the uses of the resulting paper or board products. Laboratory work suggests that fibres can be recycled between 5-7 times.

Fibres ultimately fail by loss of strength caused by reductions in length and inter-fibre bonding - fragments of fibre becoming sludge during reprocessing.

In practice, the number of times a fibre is likely to be recycled depends on what it was used for and the probability of its recovery (collection), for recycling.

Assuming one starts with 100 tonnes of paper and board made from virgin fibres and that the products reflect the proportions of different products in the market. With a recovery rate of 50%, and reprocessing losses of 20%, the amount of product remaining after the third recycling is only 8 tonnes.

Some products by nature of their use take the fibres out of the paper cycle altogether. Examples include the baseboard for plasterboard, archived printed material, book covers, graphic board, cigarette paper, tissues, and some food cartons.

Can cartons be used more than once?

Re-using cartons in their original form is not usually practical for the following reasons:

- difficulty in collecting used cartons
- problems of cleaning used cartons
- damage caused by opening and, possibly, repeated opening and reclosing
- reduction in board stiffness which would be caused by re-use
- tamper-evident packaging can only be used once
- time limited nature of on-pack promotions
- difficulty in running recovered cartons on packing lines efficiently

What is de-inking?

It is a process whereby ink is removed from printed paper and board prior to reprocessing.

Recovered paper and board is dispersed in water and the resulting fibres are treated with surfactants which extract the ink particles. The fibre is separated from the ink particles by a cascading, floatation process based on the difference in density between the two materials. Finally, a mild bleaching treatment may be included to increase the brightness of the pulp.

The major uses of de-inked fibre are in the manufacture of tissues, newsprint and stationery products. It is not widely used in cartonboard manufacture.

What is “organic recycling”?

Organic recycling occurs when organic material in waste is broken down by micro-organisms to produce a soil conditioner, or mulch, which can be used in agriculture and horticulture. Cartonboard is ideal for composting because cellulose fibre is biodegradable. This means that it can be broken down into natural substances by bacteria using microbial enzymes, thereby producing carbon dioxide, water and compost (humus).

COMPOSTING CARTONS

Composting is suitable for that part of the post consumer used cartonboard stream that cannot be recycled as fibre due to technical and cleanliness reasons.

Compost can be made from raw materials high in carbon, such as cartonboard, combined with a material containing nitrogen. For waste managers and local authorities this will provide an alternative process to recover part of the packaging waste stream.

The first stage is the source segregation of cartonboard at the household. Paper and cartonboard are collected, often with other dry recyclable materials, separately from other wastes. The materials collected together can then be sorted at a Materials Recycling Facility (MRF) before onward transfer to the recycler. After the components suitable for recycling are sorted and sent for reprocessing, any residual material comprising cartonboard and paper is suitable for composting.

An organic waste, such as sewage sludge, provides the source of nitrogen. The selection of the source is guided by what is most easily available from waste treatment facilities and waste from agriculture.

Pro Carton and ADAS Consulting, a company with wide experience of working in the environmental and agricultural sectors, have co-operated in developing specific processing guidelines for the processing of cartonboard packaging and agricultural wastes.

This work has shown that the waste sources must be combined in proportion to give an optimum carbon to nitrogen ratio of around 30:1.

For a typical cartonboard and sewage sludge mix this is 3 parts cartonboard to 4 parts sludge by weight. It is essential to laboratory test the feedstock for carbon, total nitrogen, dry matter and trace metals to achieve the right mix. For the best results, the paper and cartonboard should be shredded before mixing with the other materials. Alternate layers of cartonboard and sludge should be built into a windrow (heaped row) 2.3m wide and 1.3m high.

A wheeled loader or a compost turning machine is used to mix and turn the windrow. The windrow should be turned twice in the first week, by which time temperatures will have risen towards the target of 60^{0}C. The windrow should then be turned weekly for up to 8 weeks. Following screening to remove any contraries such as plastics, the compost is ready for use as a soil improver.

The screened compost is visually attractive, being fine in texture, light brown in appearance and odourless. Its main application is as a soil improver for both large scale landscaping use and in the garden. It can be used as a replacement of peat-based materials in proprietary composts. It has been used as a soil improver for planting trees on a site in the National Forest in Central England.

What are the benefits of composting post consumer cartonboard packaging?

- Diversion of used cartonboard packaging from landfill
- Recovery and recycling of packaging material
- Results in a beneficial soil improver
- Provides a sustainable alternative to peat and proprietary composts
- Diversion of used cartonboard from mass burn incineration