

Chemical use in the production of recycled paper

Question:

Are the chemicals used in the production of recycled publication, magazine and copier papers (printings and writings) environmentally better or worse than those used in virgin production?

Chemical use in the papermaking process only represents a single element in the overall equation measuring environmental impact. This said, there are a number of chemicals used in the manufacture of paper, either to optimize the product properties or the manufacturing process.

The chemicals can be segregated into the following categories; sizing agents, dry strength agents, wet strength agents, dyes, fillers, retention aids, effluent chemicals, pulping chemicals, bleaches and de-inking chemicals, the exact types and quantities used being specific to the product made or manufacturing process.

This leaflet considers the manufacture of equivalent products within the printings and writings sector, using comparable manufacturing technologies based on recovered fibre (recycled manufacture) and virgin fibre. The use of sizing agents, dry strength agents, wet strength agents, dyes, fillers, retention aids and effluent chemicals, are similar for both virgin and recovered fibre, whereas there are pronounced differences in the use of pulping chemicals, bleaches and de-inking chemicals, as described below.

Virgin paper production

There are two main methods of pulping wood to obtain a material for paper manufacture:

- mechanical pulping; and
- chemical pulping.

Mechanical pulping forces the fibres apart to produce a suspension, whereas **chemical pulping** dissolves the lignin, which cements fibres together.

As a result, chemical pulp is stronger than mechanical pulp and does not yellow. For these reasons, chemical pulping is much more prevalent in the manufacture of printings and writings grades. Most chemical pulp is made using the sulphate process (also known as the Kraft process). Wood chips from de-barked logs are dissolved in caustic soda (NaOH) and sulphur based compounds (usually Na_2S) by heat and pressure, leaving a strong brown pulp, coloured by the effects of the chemicals on the lignin and sap. Some of the chemicals are then re-circulated through a complex process. A particular feature of the sulphate process is the smell created, which is very noticeable in the vicinity of the mill (although this is less of an issue in modern mills).

The pulp is then bleached. Bleaching technologies have advanced through the last few decades, both in terms of efficiency and environmental impact, with chlorine becoming less prevalent and hydrogen peroxide and oxygen becoming more so. In approximate chronological order, the following methods have been used worldwide, usually in combination:

- chlorine in acid;
- hypochlorite in alkaline;
- chlorine dioxide in acid;
- hydrogen peroxide in alkaline;
- oxygen under pressure in alkaline;
- ozone under pressure in acid (not yet in common use).

Unbleached softwood sulphate pulp has a brightness of around 25% (ISO). After bleaching, printings and writings papers often demand a brightness of 85% and above. To reach these levels an amount of chlorine dioxide bleaching may be needed in some processes.



Recycled paper production

When manufacturing recycled paper, the raw material, recovered paper, is already white – it has already been through the process described overleaf. As such, there is less emphasis on bleaching and more on the process to remove ink, with a small level of bleaching taking place as a final stage.

The de-inking process first re-pulps the recovered paper, mechanically removes coarse contaminants, and then mechanically cleans the pulp using centrifugal cleaners. This is followed by flotation, where air is added to a dilute suspension of pulp.



De-inking chemicals are added to prepare for this (mostly in the pulping sequence), typically these are caustic soda (NaOH), soaps or fatty acids. The ink then attaches to the air, floats to the top of the cell and is removed as a sludge. Following the de-inking process the pulp has a brightness of about 50% (ISO). In the manufacture of most recycled printings and writings grades, the de-inked pulp is also bleached, usually with hydrogen peroxide to bring the brightness above 85%.

European paper mill environmental legislation

In addition to the types of chemicals used, all European mills, whether virgin or recycled, will follow IPPC (Integrated Pollution Prevention Control) authorised processes and therefore meet, or have active programmes to achieve, the best available technique standards set out in the BREF (Best Practice Reference Document) produced by the EU Commission. This ensures that they meet very exacting EU Environmental standards.

Conclusion

Both recycled and virgin paper production processes use significant levels of caustic soda (NaOH) and various bleaches, however, noticeably higher volumes are used in the manufacture of virgin papers. Also, sulphur-based compounds are used in the virgin paper sulphate process, whereas additional soaps and fatty acids are used in the manufacture of recycled papers.

Answer:

It can therefore be concluded that the chemicals used in the manufacture of recycled papers have a lower, or at worst similar, environmental impact to those used in the manufacture of virgin papers.

About WRAP

WRAP (the Waste & Resources Action Programme) is a major UK programme established to promote resource efficiency. Its particular focus is on creating stable and efficient markets for recycled materials and products and removing the barriers to waste minimisation, re-use and recycling.

More information on all of WRAP's programmes can be found on www.wrap.org.uk

CONTACT



70% recycled
Minimum 70% recovered fibre.

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