

Pulp fiction

The ability to deink and recycle paper makes it a very environmentally friendly solution, but will the increasing use of inkjet printers threaten this?

Paper accounts for the biggest impact of the printing process on the environment so one of the most obvious ways of reducing that impact is to use recycled paper. This can cut down the amount of energy and water needed to produce the paper in the first place, as well as generating less greenhouse gases. There are plenty of recycling mills that specialise in pulping used paper, removing ink and other contaminants from it and using it to make new paper.

There are several deinking processes but by far the most prevalent is the flotation method, with most mills using a two-loop system. This involves soaking the paper in water in a pulping machine and then adding surfactant chemicals such as caustic soda, peroxide, sodium silicate or soap, which create a sticky froth on the top of the resulting pulp. Air bubbles are blown through the pulp, carrying the ink to the surface where it is trapped in the surfactant froth, which can then be removed, allowing the water to be reused again.

Without question, offset lithography remains the dominant form of printing throughout the world, and so most of these recycling mills are optimised to deal with offset printed papers. However they can cope equally well with most other print technologies, including dry toner.

Inkjet problem

The recycling industry is represented by Ingede, the International Association of the De-inking Industry. Ingede has highlighted a potential problem with the new generation of high speed inkjet printers, such as the Jet520 series from Screen, the Jetstream from Océ, Kodak's Prosper and HP's Inkjet Web Press. These all use water-based inks and there is the potential for the inks to contaminate the water used in the recycling process, as Axel Fischer, press officer for Ingede, explains:

“As long as you have water-based inks you run into this problem that your printed product is like a red sock in the washing machine; if you put something in the system and it's water-based it dissolves.”

It should be pointed out that not all inkjet systems are affected by this. Ingede has said that Fujifilm's forthcoming Jetpress exhibits good deinkability. This appears to be because the Fujifilm system relies on precoating the media immediately prior to jetting the ink, which fixes the ink dots, preventing them from spreading into the paper fibres.

Xerox's Production Inkjet System has also passed the Ingede test. This uses solid inks, which are melted to liquid form to allow them to be jetted, but then solidify



Ingede says that some inkjet printers do exhibit good deinkability, such as Xerox's Production Inkjet System.

as they bond with the media. When it comes to deinking the ink breaks down into large enough particles to be carried away by the flotation process.

Nonetheless, four of the main inkjet vendors – HP, Kodak, Océ and InfoPrint – were worried enough to form their own trade association known as the Digital Print Deinking Association, or DPDA. Ostensibly this was to allow these companies to pool research and to defend the inkjet corner. It's fair to say that beyond the formal pleasantries there wasn't much love lost between Ingede and the DPDA.

But over the past year there has been a thawing of the relationship as more research has helped to clarify the situation and the two organisations are now working much closer together. One of the big bugbears was the

method 11 test that Ingede uses to determine if an ink is good for deinking, which the DPDA claimed did not reflect the conditions found in a typical recycling plant. Last year Ingede announced a new version of its method 11 test that addresses some of these issues.

Nils Miller, HP's senior scientist for inkjet R&D and environmental strategies, explains: "The older method 11 did not correctly simulate the PH of a deinking mill with certain papers so some papers you would do the test and the resulting PH would be more or less what you would see in a deinking mill. But with other papers you would get artificially high PH, say around 10.5. Now, there are some inks on the market where incorrect PH would not greatly affect the outcome but in the case of inkjet that could hugely affect the outcome. With these artificially high PHs you could convert the ink into a hydrophilic form and so it's no longer hydrophobic and that really reduces the efficiency of removal in deinking."

Improvements to inks

But of course there's more to the issue than the method 11 test itself. Not surprisingly, as the inkjet printers have become more common in real world use, so the vendors have learned more about how the systems work in practice. For example, HP believed from its earlier research that the bonding agent it used to help

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its inks work better with some papers was also helping when it came to deinking. But Miller now says that the interaction between the ink and the paper is a much bigger factor.

As a result of this new research HP has made some changes to its ink formulation for the T350. Essentially the difference is the way that the tiny pigments in the ink aggregate together when they are printed. Miller explains: "During printing these pigments aggregate

strongly together so you want a dispersion technology that has good aggregation behaviour during the printing and also maintains that aggregation during deinking. You're essentially detaching the ink film from the paper



Nils Miller, HP's senior scientist for inkjet R&D and environmental strategies.

and the ink film is breaking up into chunks, but not into discrete particles, so it's retaining a size in the order of microns as opposed to hundredths of nanometres."

Because the ink particles are bigger they can be separated from the paper fibres along with the other contaminants. Miller says that in some cases the deinkability with this new ink is better than with some offset presses. For now the new ink is only used with the T350 but should be compatible with the existing T300 as well.

High value papers

But ink is only part of the equation, with some papers appearing to be easier to deink than others – no surprise there as it is also easier to print with inkjet to some papers than others. Indeed, this is one of the challenges of inkjet technology, in developing suitable media, something that is still in its infancy. For now, the available research indicates that it is easier to deink wood-free papers, which generally means the sort of graphic arts grades normally used in offices.

Indeed paper mills will pay a premium for waste paper collected from offices, which is generally white bright wood free papers, as this can then be recycled it into the same kind of high quality paper and sold for a higher



Paper mills will pay a premium for office grade waste paper so they can't afford dirt specs in the deinking process.

price. Julian Long, UK key account manager for Arjo Wiggins, explains: “We have contracts with companies that will collect waste from offices. The grade is known as sorted ‘office waste’. We try to encourage people to close that recycling loop.”

In contrast, most household waste paper ends up at newsprint mills, and is worth less because of the greater mixture of different types of paper produced on different print technologies. Miller says: “I don’t expect that web presses are going to be used primarily for newsprint applications, but there will be a lot of book publishing and a lot of that will be on paper types that will end up in a newsprint mill.”

Indigo problem

One of the reasons that HP has taken such a lead on inkjet deinking is because of the problems that it has had with its Indigo presses. As a general rule, Indigo prints do not do well in the Ingede Method 11 tests, yet HP claims that independent tests show that Indigo prints can be deinked. So, who’s right?

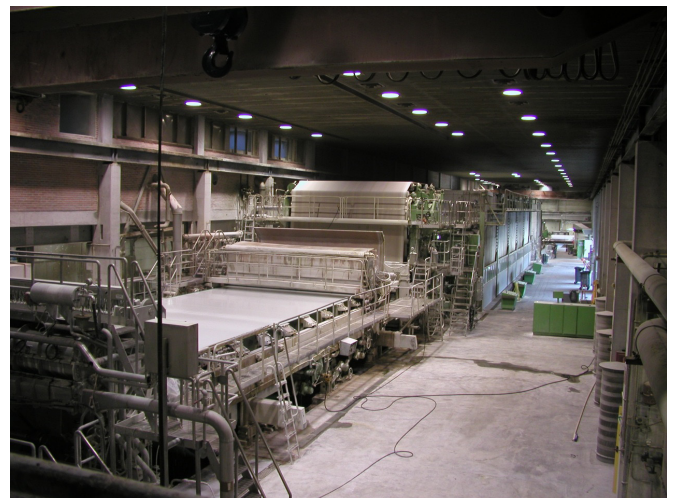
Well, it comes down to the test being used. HP has had independent tests conducted by the CTP lab in France, which used a test that simulated the conditions typical of a European wood-free deinking mill, since most Indigo customers are using wood-free media. But this test differs from Ingede’s method 11 test as it uses different chemistry, different pulping procedure, and a different

post-treatment. This test showed that five out of the six papers tested with the current indigo ink showed good deinkability.

HP has also been involved in a separate trial with Michigan University, which shows that in a real world situation where Indigo prints account for up to five percent of the waste paper, the papers can be successfully deinked.

Miller believes that this vindicates HP’s claims, adding: “Our customers want to know if their prints can be turned back into pulp that can be made into high grade paper that could be used by an Indigo press for an end to end recycling process, so on the Indigo side our research has been targeted to answering that cradle to cradle recycling question.”

But all this was brought into sharp focus last year when a German paper mill claimed that its pulp had been contaminated with dirt specs caused by Indigo prints.



Arjo Wiggins’ Dalum mill in Odense, Denmark produces high quality recycled paper such as the 100 per cent recycled paper, Cyclus.

The mill in question was producing high quality wood free paper, and Miller says that this should have been able to cope with Indigo prints. The contamination was traced back to a photobook printer using a HP Indigo printer.

It appears that an overflow bin containing mainly offcuts and calibration sheets was sent to the mill in one go,

meaning that somewhere in the region of 140 tonnes of the same paper was mixed directly with the other paper going into the recycling process. It's a highly unusual situation since most mills would expect to have a much greater mixture of different types of paper from different sources. HP is still investigating the incident to find out what did go wrong, though Ingede says that this proves that Indigo prints are not suitable for deinking for making graphic arts grade papers.

Conclusion

Ultimately this comes down to economics as there's no question that just about any kind of print can be recycled and reused for making all sorts of paper products, including newsprint, tissue or cardboard. But these are all relatively low value products. The real issue lies around the higher value graphic arts grade papers, and who pays to ensure that these papers can be recycled. Should it be the inkjet vendors who develop inks that are easier to deink, or the paper mills that are making the paper?

For now, inkjet accounts for an insignificant proportion of the waste paper being recycled but everyone is keenly aware that as more inkjet printers are sold so the problem will become more acute. But given that Fujifilm and Xerox have developed inkjet systems that pass the Ingede tests, the emphasis has to be on the inkjet vendors to ensure that all, rather than some, papers can be deinked.

Nessan Cleary 

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