Reduce, re-use, re-dye?

Is recycled polyester really good for the environment?
Phil Patterson takes a look at some of the current issues and challenges with dyeing recycled polyester fabrics.

Polyester is basically made from oil and as we all know the world’s supply of this commodity is projected to run out at some point over the next five decades or even sooner. Although a few abiotic theorists still believe that oil is made at the same rate as it is being currently used.

Therefore it is logical to assume that anything that reduces the amount of oil being used is a good thing, and the use of waste drinks bottles as a feedstock for polyester yarn seems to make good sense – so much so that demand has gone through the roof and there are confirmed reports of virgin bottles being made as feedstock for yarn, simply to get the coveted ‘recycled’ label.

There has to be energy used to transport bottles from collection points to the polyester yarn or chip factories so it’s not all good news, but on balance, to the point of yarn manufacture, recycled polyester yarn is very much in credit compared to virgin polyester.

But what happens after yarn production?
Does recycled polyester still compare favourably from an environmental point of view when we look at downstream processing?

We’re not aware of any major problems with knitting, warping and weaving recycled polyester.

The yarns are pretty consistent for mechanical processing nowadays but there is a growing rumble of discontent coming from within the dyeing industry.

Good dyers tend to work on the principle that if they have consistent raw material, consistent dyes and chemicals and that if they carry out a consistent process then they will get a consistent end product. (There’s obviously a lot of science behind dyeing processes but dyers who don’t take heed of the above simple principle will not be successful.)

We’ve already written in previous issues of Ecotextile News that normal, everyday polyester is fairly good from an overall environmental point of view compared to other fibres - on the basis of its superb consistency (allowing dyers to get excellent shade consistency), simple dyeing process and good colour build up and high dye fixation.

It tends to be better dyers who take on the challenge of new fibres and therefore new fibres like recycled polyester quickly become subjected to critical review by high quality industry professionals.

However, we have noted through our conver-
sations with these dyers that the re-cycled yarn is not as good as virgin polyester and is causing them some difficulties.

**Different types**

It is worth noting that there are two broad types of recycled polyester: the first is simply melted and re-extruded into fibres and the second goes through a multi-stage de-polymerisation and re-polymerisation to produce the yarn. Information from experts in the industry indicates that the multi-stage re-polymerised yarn is significantly better in terms of quality than the simple melt process.

So let's have a look at the problems in more detail — not all recycled yarns are significantly inferior to virgin fibre and not all inferior yarns suffer from the all the following problems, but it is worth considering these as potential issues before launching into a programme on the assumption that everything will be OK.

Even where yarns look the same, inconsistency of dye uptake makes it difficult to get good batch-to-batch colour consistency and can result in high levels of re-dye.

Re-dyeing is probably the biggest contributor, and certainly the least excusable contributor to the negative environmental impacts of dyeing and at some stage it will be necessary to calculate if the savings on non-renewables in fibre manufacture are being offset by increased water, energy and chemical use of re-dye.

The inconsistency could be caused by a number of factors that are controlled to the nth degree in virgin fibre production, namely:

- Degree of polymerisation (the length of the polymer chains)
- Oligomer content (the short chain length polymers)
- Crystallinity (how easy it is for dyes to get in and out of the fibre)
- Cross-sectional shape (any variation gives difference in lustre and colour yield)

Additional things for retailers to think about with some yarns are the level of PVC content, (this can get into the system via bottle labels and wrappers), levels of dulling agents and also the amount of virgin polyester — since many yarns have some recycled content and some virgin polyester content.

There are also reports that the base colour of re-cycled polyester chips are varying from white to creamy yellow and this has two major drawbacks. Colour consistency is difficult to achieve, particularly on pale shades, and some dyers are struggling to get a good white shade — to the point where they are using chlorine-based bleaches and are still struggling to achieve a high degree of whiteness.

Many recycled polyester yarns have been used in visually forgiving constructions such as polar fleece (the fabric construction do a good job of hiding any slight yarn variations) but as the yarns find themselves in super-critical end uses, such as satins, there does appear to be a few concerns over streaks and stripes — but anyone dealing with filament yarns in critical end uses knows that this is a part of everyday life, even for well-established players in the market.

**More dyestuff?**

Unsubstantiated reports are claiming that some recycled yarns take almost 30% more dye to achieve the same depth of shade as equivalent count virgin material but this may be because dyers are using high fastness, low build up dyes at lower dyeing temperatures.

It's a fact of textile life that new fibres take a while to bed down and it's also a fact of textile life that there will always be someone ready to jump on the bandwagon with an inferior version of the latest trend.

Not all recycled polyester yarns are causing problems and it would be a shame if their reputation was dented by the poorer quality alternatives, so it's important that any constructive criticism from reputable dyers should be used to encourage buyers and dyers in the textile industry to focus on quality rather than being seduced by 'recycled fibre' badges alone.

It's clear that recycled polyester fabrics are good for both the industry and the environment but if the market gets flooded with fibre that can't be dyed consistently that view will soon change.

There is one final thing to consider if the sums don't add up and the debits of inefficiency outweigh the credits of lower oil use. Polyester bottles have a tremendous calorific value so can be burnt to provide energy for any process, including textiles. And do you know what? Despite this being counter-intuitive it does just the same thing as recycling them into yarns — it saves oil resources being depleted.
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