The Deakin team has found a solution to the dyeing process, a known stumbling block in recycling fabric.

Greener way to recycle clothes passes with flying colours

An ENVIRONMENTALLY FRIENDLY method to turn fabric back into fibre is a breakthrough in tackling the huge problem of textile waste.

In Australia alone, more than 500,000 tonnes of clothing waste is sent to landfill each year, making it the second largest waste material after plastic. Researchers at Deakin University's Institute for Frontier Materials (IFM) have developed a 'fibre to fibre' technology to recycle textiles, based on cotton being an excellent cellulose feedstock. The research is part of IFM's focus on designing materials and processes for a circular economy.

The institute's Associate Professor for Circular Design, Nolene Byrne, who leads the research, says that current mechanical methods of recycling cotton textiles shorten the fibre length, meaning that only 30% of the recycled fibre can be incorporated into new fabrics without compromising quality and performance.

By contrast, in the method developed by Byrne and her team, 100% of the recycled fibre can be reused. They have developed a binary solvent containing an ionic liquid to dissolve the cotton, and an aprotic solvent, which reduces the cost, makes recovering the solvent easier and improves the processability. The technology uses wet spinning to create a regenerated cellulose fibre (RCF) which means that 100% of the recycled fibre can be used to make new fabrics. The team has shown the resultant fibre is similar to commercial RCF known as viscose.

Dyeing was a particular focus for Byrne's team, given its heavy environmental toll. Mechanical recycling often sorts fabrics by colour to reduce the need to re-dye. Byrne and her team explored different pre-treatment methods for the waste textiles, and have been able to create new fibres without any loss in colour intensity or fastness. It is this aspect of the technology that is truly ground-breaking. Their discovery is applicable to polyester cotton blends, where the recovered polyester shows no chemical degradation and no decrease in colour intensity. Yields of 97% are achieved in laboratory trials.

Cellulose is a complex, strong carbohydrate with many industrial uses and the regenerated cellulose has other potential applications. In another project, Byrne's PhD student has used it to make aerogels — synthetic, ultralight materials comprising a network of micron-sized pores and nanoscale tunnels.

DYEING WAS A PARTICULAR FOCUS FOR THE TEAM

"Because of their low density (they are sometimes known as liquid or frozen smoke) aerogels make excellent materials for bio scaffolding, absorption or filtration," Byrne explains. While this research is at an early stage, possible uses include synthetic cartilage or cellulose beads for drug delivery.

The research is part of IFM's broader focus on redesigning materials for a circular economy and developing innovative ways to achieve value from waste. The circular economy strategy also includes a focus on energy materials, carbon fibre and composites, advanced alloys and infrastructure materials. ■

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