KU LEUVEN

The Fiber Society 2022 Spring Conference

Fibers for a Greener Society: From Fundamentals to Advanced Applications

May 30–31 and June 1, 2022

Conference Co-Chairs

David Seveno, ***KU Leuven, Belgium***
Aart Willem Van Vuure, ***KU Leuven, Belgium***
Carlos Fuentes, ***Luxembourg Institute of Science and Technology (LIST) and KU Leuven, Belgium***

Venue

Maria-Theresia College
Leuven

Program

Sunday, May 29

2:00 PM–5:00 PM	The Fiber Society Governing Council Meeting (Second Floor, Room 02.10)
5:00 PM–7:00 PM	Early-bird Registration and Welcome Reception (Ground Floor, Room 00.03)

Removing Harmful Finishes to Recycle Waste Acrylic Textiles

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RECYCLING ACRYLIC TEXTILES

Every year, within Europe, 7700 tonnes of acrylic textiles are disposed of by landfill or incineration. Recycling this waste would conserve over 8 times the energy regained from incineration. In addition, acrylic fibres are predominantly solution spun using toxic and carcinogenic solvents such as dimethyl formamide, so mechanically recycling these fibres would avoid the need for re-extrusion using these solvents, thus providing a benefit to health. Despite these benefits, acrylic textiles are not currently recycled.

One crucial reason for this lack of recycling is the presence of finishing chemicals on the fibre substrate. These include harmful formaldehyde- and fluorine-containing resins, which complicate the recycling process and remain in the recycled product, thus limiting its application potential and remaining a health risk. These finishes must thus be removed at the start of the recycling process, which is one of the goals of the REACT project.

THE REACT PROJECT

Within the REACT (Recycling of Waste Acrylic Textiles) project, acrylic fabric samples were investigated, originating from outdoor textiles. Three different finishes were identified on these fabrics: an awning finish (containing a formaldehyde resin and a fluorocarbon resin), a coating (containing the awning finish underneath a thicker acrylic resin coating) and a furnishing finish (containing a fluorocarbon resin and softeners).

Many (confidential) treatments, including hydrolysis, washing and other physical treatments, were investigated to remove the finishing chemicals from all three fabric types. These treatments were applied individually and in combination, and their results were evaluated by Fourier-transformed infrared spectroscopy via attenuated total reflection (FTIR-ATR), and by the standardised oil-repellency test AATCC 118-2013.

While individual and sequential hydrolysis treatments showed a lot of promise and were fine-tuned, a particular combination of sequential processes was optimised and found capable of removing more than 90% of all the chemical components present on the waste acrylic fabrics; see Table I. These proposed laboratory-scale processes are now being up-scaled for industry and will enable the further recycling of acrylic fabrics.

Table I: Finish removal percentages as evaluated by FTIR-ATR, on each identified waste fabric type.

		Formaldehyde resin removal (%)	Fluorocarbon resin removal (%)	Acrylic resin removal (%)	Softener removal (%)
HYDROLYSIS 1	awning fabric	> 90	50 - 80	-	-
	Coated fabric	< 30	< 30	< 30	-
	Furnishing fabric	-	50 - 80	-	50 - 80
HYDROLYSIS 1&2 + WASHING	awning fabric	~ 100	50 - 80	-	-
	Coated fabric	50 - 80	50 - 80	50 - 80	-
	Furnishing fabric	-	50 - 80	-	~ 100
HYDROLYSIS 1&2 + WASHING + PHYSICAL TREATMENT	awning fabric	~ 100	> 90	-	-
	Coated fabric	~ 100	~ 100	~ 100	-
	Furnishing fabric	-	> 90	-	~ 100

ACKNOWLEDGMENT

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