

All-Cellulose Composite



\Project Overview

Enhancement of structural and surface properties of woven cellulosic fabrics made from Piñayarn® without the use of petroleum-based coatings to simplify end of life solutions.



\Team



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\Objectives

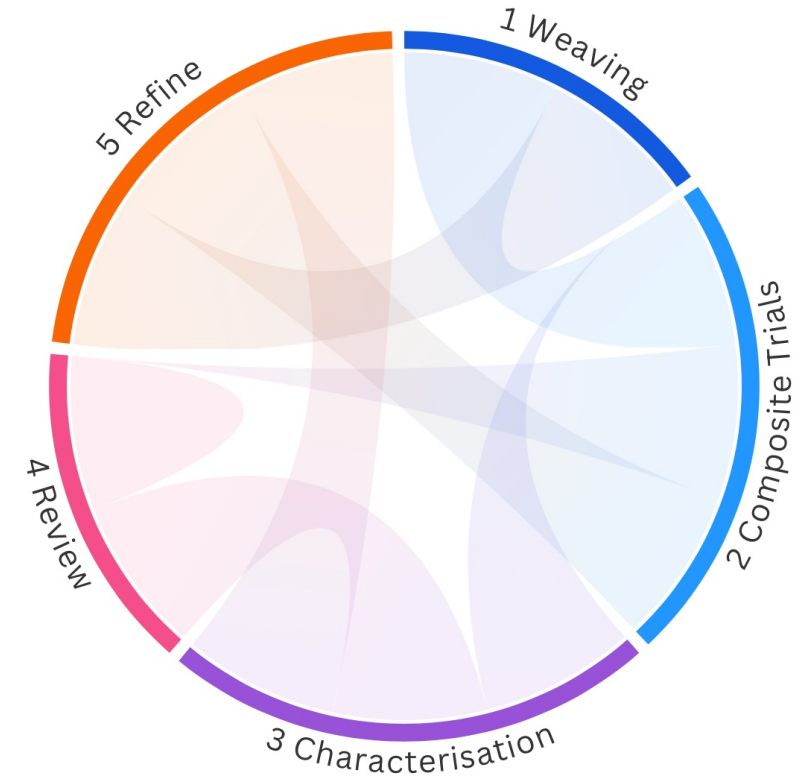
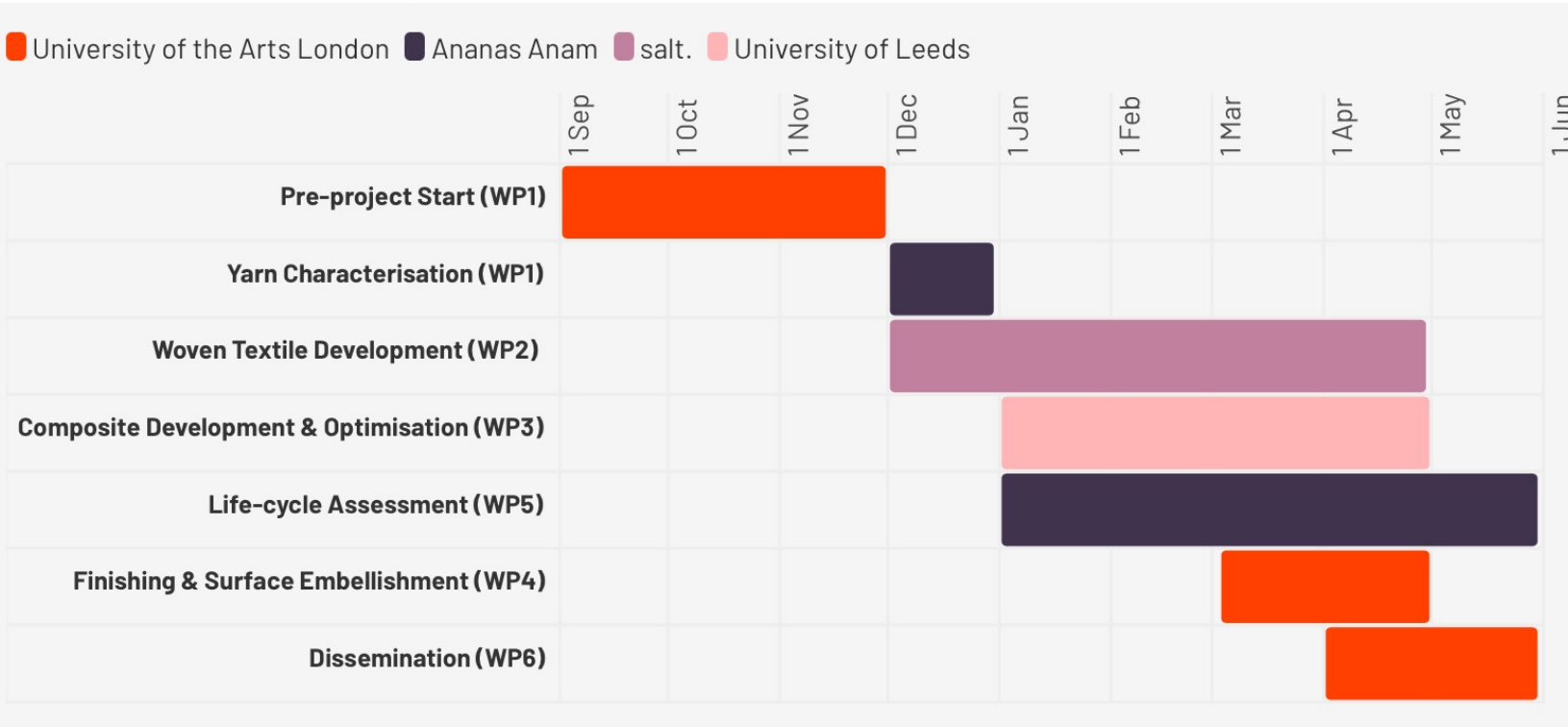
To widen applications for Piñayarn® whilst simplifying end of life possibilities using recycling, re-manufacture or composting

To understand the effect of woven constructions on mono-composite technology

To explore impact of mono-composite processing parameters to achieve varying degrees of flexibility



\Plan

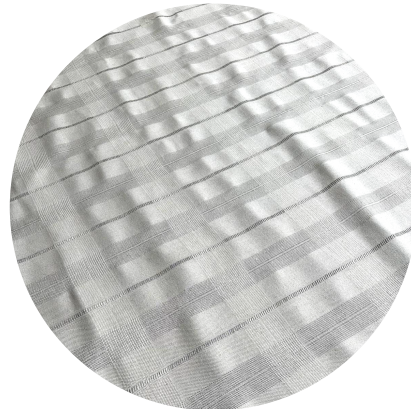
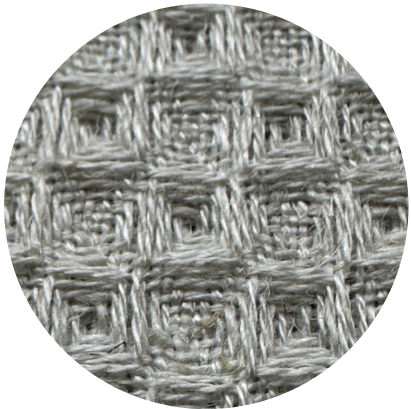


WP2/ Woven Textile Development

3 x warps exploring the effect of yarn count, weft density and stitch structure on fabric quality

Fabric design developed in response to insights from composite processing and client feedback including a well-known automotive company, architectural and interior sectors

Overall 37 woven samples have been produced

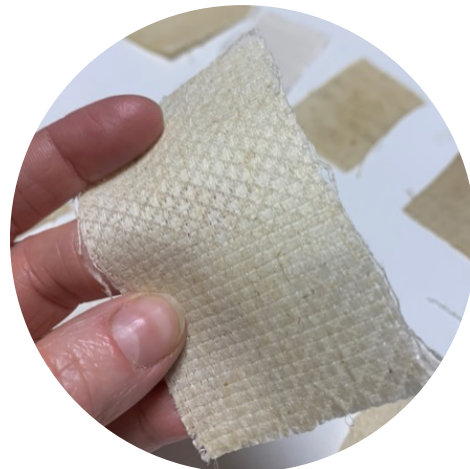


WP3 \Composite Trials & Optimisation

All 37 woven fabrics have been tested with the mono-composite process at University of Leeds

Composite samples explore the effect of material lay-up, pressure, solvent ratio, solvent mix, time, colour and 3D shaping etc.

Over 100 composite samples have been tested and recorded as well as a final collection of optimised larger pieces and 3D shapes

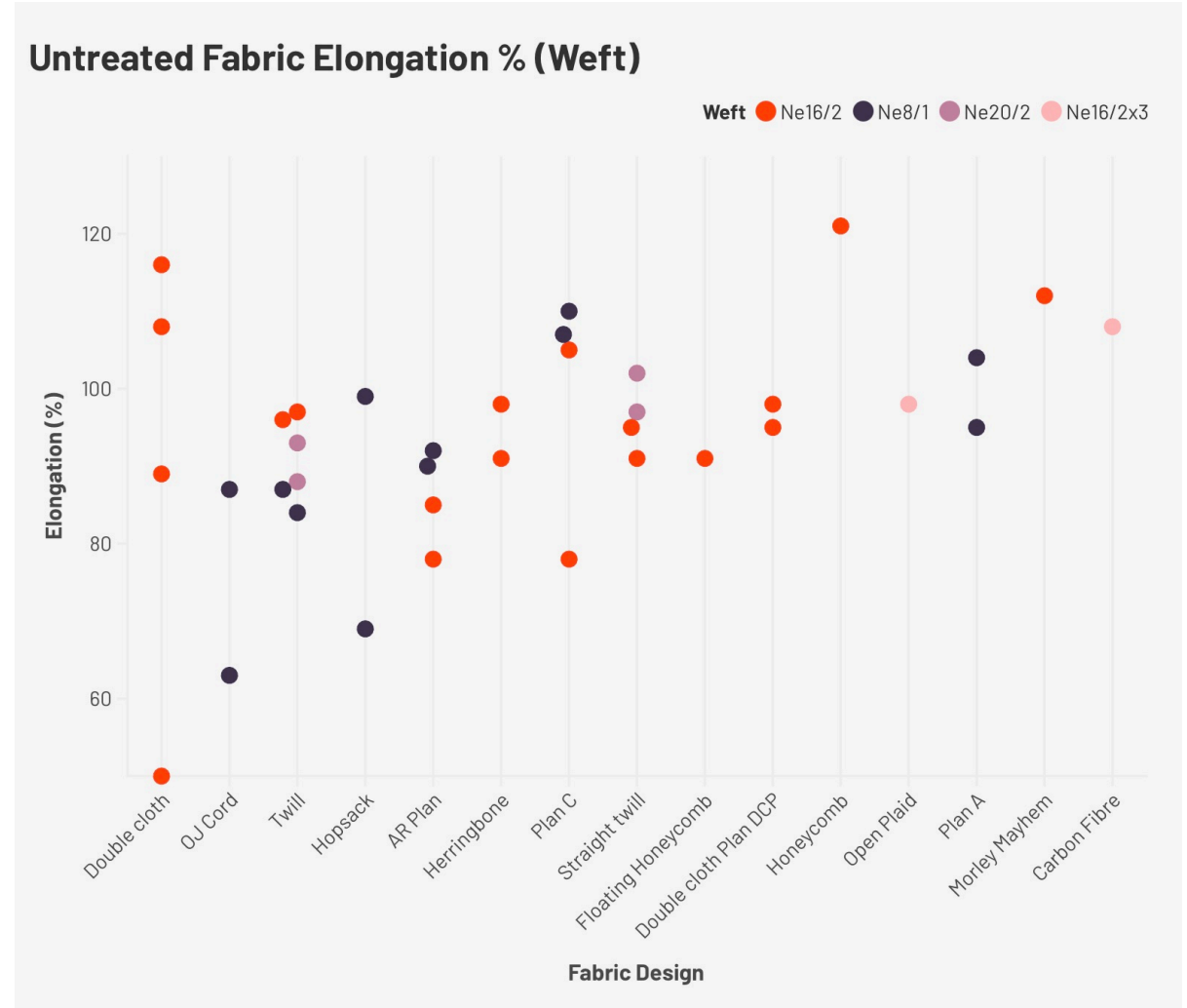


\Testing Insights

A full quantified dataset of woven samples and selected composites has been produced testing fabric tear & tensile strength, elongation and pilling

Results show:

- Fabric structure and composite parameters can be used to offer controlled mechanical properties with variable flexibility
- Composite processing of woven fabrics improves abrasion resistance significantly from <5,000 cycles to >60,000
- Composite processing reduces fabric stretch/elongation

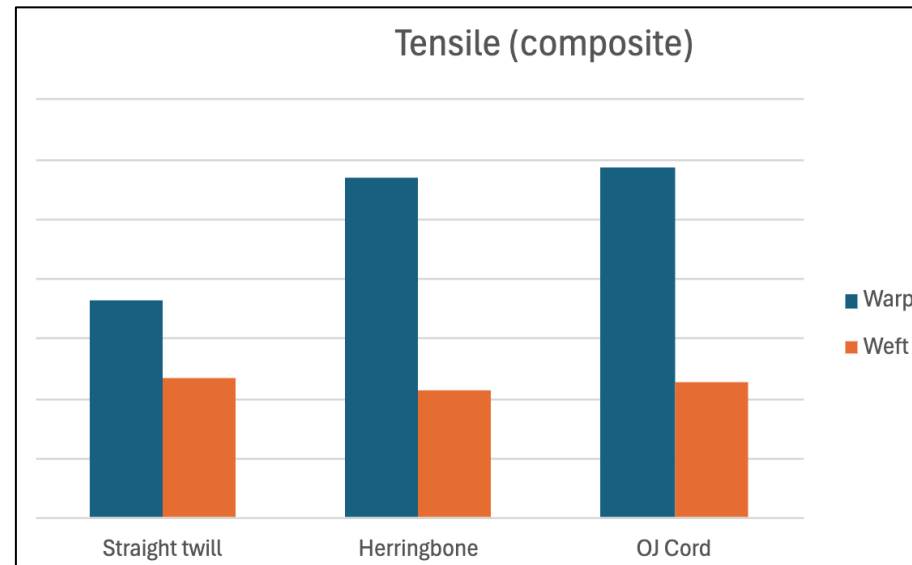
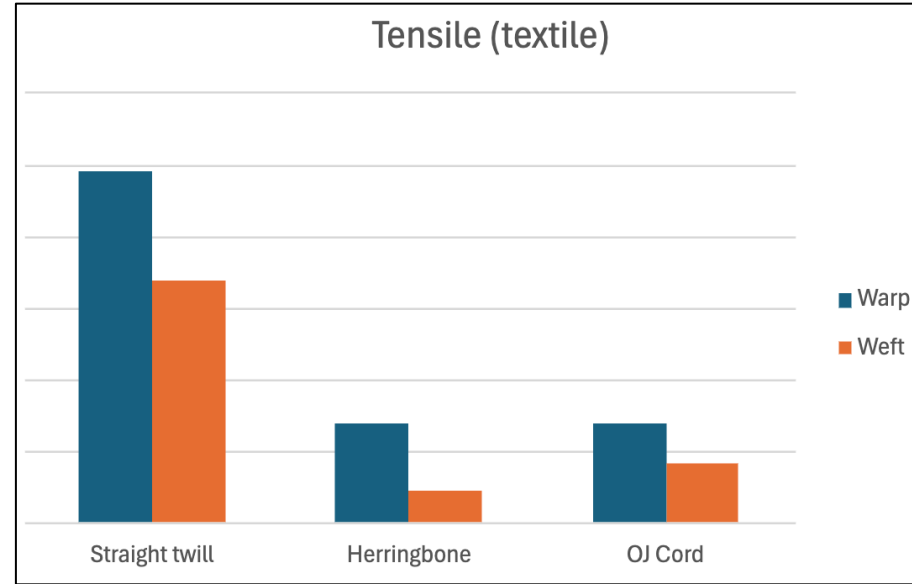


\Testing Insights

Untreated fabrics with lower tensile performance gain most strength as a result of composite processing

The OJ cord has the lowest tensile strength as untreated fabric, but the highest tensile strength after composite processing

This indicates that open structures allow better penetration of the solvent increasing the effect produced by the IL on the cellulose to get stronger materials



WP4 \Surface Enhancement & Embellishment

‘The brief is looking for creative surface experimentation of woven materials made from Piñayarn® through processes sympathetic to the ethics of the Ananas Anam’s work which aims to create bio-based, circular and local textile eco-systems.’

WP4 \Surface Enhancement & Embellishment

15 x Chelsea Textile Design students submitted samples exploring finishing opportunities including natural dyeing, screen printing, embroidery, applique, shibori and more!

2 x students Luna Smith (BA) and Elanka Jiang (Grad-Dip) demonstrated exceptional finishing techniques for the fabric and have been selected to have their samples tested with the mono-composite process at University of Leeds



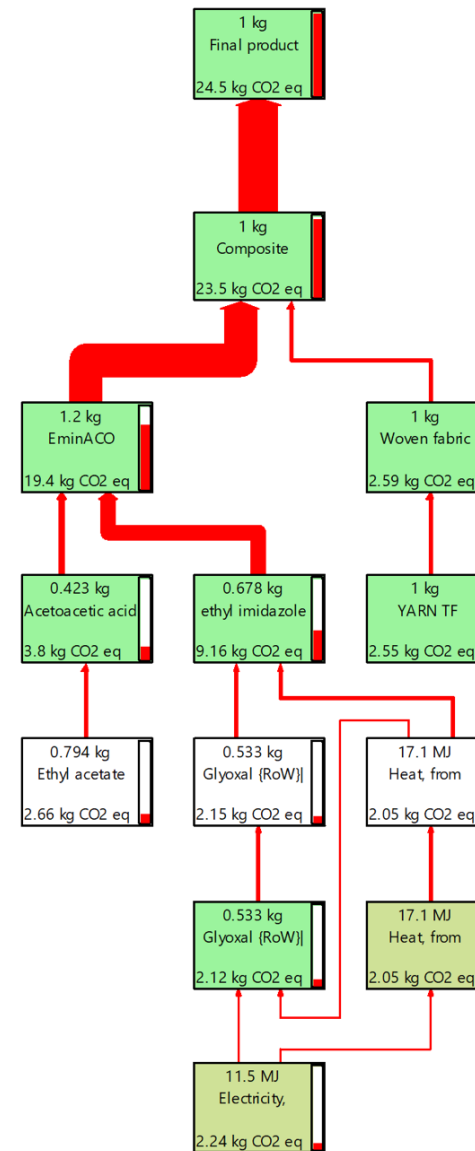
WP5 \Life Cycle Analysis

A cradle-to-gate LCA has been carried out on the Piñayarn® all-cellulose composite using SimaPro software

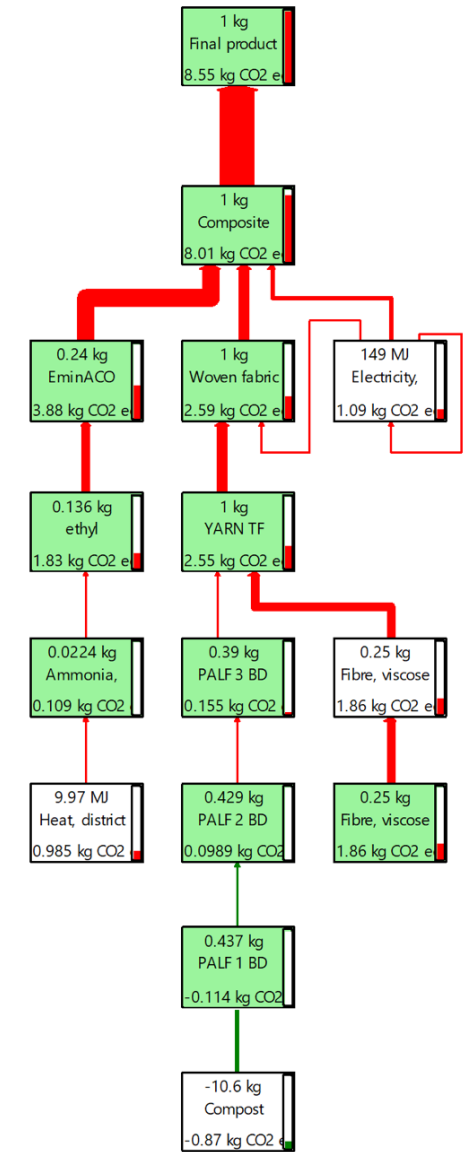
LCA Aim: To understand environmental impacts at each stage of production and to identify hotspots for improvement

The study showed environmental impact of the composite process is significantly reduced by reusing the Ionic Liquid 5x

Scaling of production and European sourcing of IL would help to reduce the overall environmental impact



1. Mapping contributions



2. Mapping contributions with reused IL

WP6 \Dissemination

- Abstract '**Composites made with pineapple leaf fibre: Understanding the effect of woven design on composite performance**' accepted as oral presentation for International Textile & Colour Conference at Nexus, University of Leeds. Date: 25th-26th June
- Abstract '**BIO-PERFORM: Finishing and surface embellishment of cellulosic bio-based materials that are compatible with circular systems**' accepted as full paper for FTC Futurescan 6 Conference at De Montfort University Leicester. Date: 9th-10th September



\Key Outcomes - Opportunities

Key Outcomes	Opportunities
A collection of 37 fabric samples and over 100 composite trials including 3D, and colour prototypes	Scaling of process to improve LCA and test feasibility of largescale production
Final collection of flat and 3D composite samples to be used as an industry showcase and ongoing client feedback	Client partnerships to develop process/product towards end user
A full quantified dataset of woven and selected composite samples	Light fastness and degradation testing for commercial interior application
A full cradle-to-gate LCA providing insights for process development	Exploring colour further
2 x conference paper acceptances	Recyclability/Biodegradability testing
	Water repellency/Bio replacement of Scotchgarde/FR treatment

Thank you

