Grant Agreement N°: 820869
Call: H2020-SC5-2018-2019-2020
Topic: CE-SC5-01-2018
Type of action: RIA

RECYCLING OF WASTE ACRYLIC TEXTILES

D5.4: NEW FINISHING RESULTS AND LABORATORY TESTING – EXECUTIVE SUMMARY

Work package	WP 5
Task	Task 5.2
Due date	30/06/2022
Submission date	11/07/2022
Deliverable lead	Soft Chemical
Version	v0.1
Authors	Andrea Cataldi
Reviewers	Roberto Vannucci

Abstract	Description of finishing trials, on lab scale machinery, including technical parameters and results of tests executed to evaluate the performances of the finished textiles
Keywords	Finishing textiles

Document Revision History

Version	Date	Description of change	List of contributor(s)
V0.1	13/06/2022	ToC	Andrea Cataldi (Soft Chemicals)
V0.2	11/07/2022	Internal review	Daniele Piga and Roberto Vannucci (Centrocot)

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Acknowledgment

** REPORT: Document, report (excluding the periodic and final reports)*

DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

OTHER: Software, technical diagram, etc

Project co-funded by the European Commission in the H2020 Programme		
Nature of the deliverable *:	Report	
Dissemination Level		
PU	Public, fully open, e.g. web	
CI	Classified, information as referred to in Commission Decision 2001/844/EC	
CO	Confidential to REACT project and Commission Services	✓

EXECUTIVE SUMMARY

This deliverable has been created in the context of the WP 5 (Textile production, finishing and testing) of the H2020-funded project REACT (Grant No. 820869).

The document provides laboratory testing results on new environmentally friendly finishing developed in the projects REACT. This research of a new kinds of finishing are performed to eliminate or reduce the use of high impact finishing such as fluorocarbons-based and formaldehyde-based resins.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **3**
TABLE OF CONTENTS **4**
LIST OF FIGURES **5**
LIST OF TABLES **6**
ABBREVIATIONS **7**
1 INTRODUCTION **8**
2 NEW FINISHING TEST **9**
2.1 Fluoro-free water repellent 9
2.2 Polyurethane crosslinker 9
2.3 Test results 9

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

REACH	Registration, Evaluation, Authorisation and restriction of Chemicals
ECHA	European Chemicals Agency
AATCC	American Association of Textile Chemists and Colorists

1 INTRODUCTION

The general trend in the textile industry to comply with REACH directives is to use less water and less harmful chemicals in finishing processes. However, this is not a foregone conclusion as it requires the replacement of often cheap and well-known processes and products. Such a change often leads, especially at the beginning of the process/chemical change, to quality differences, process instability and similar. In the future, the use of chemicals in textile finishing for clothing will be defined by various actors such as ECHA/REACH, environmental organisations, and brands.

Many chemicals used in textile finishing require specific attention with regard to the purchase, transport, storage, use (industrial and consumer) and end-of-waste phase of chemicals, but also of treated textiles. European legislation has been an important driver in addressing sustainable chemicals. Recently, the substitution of hazardous substances has become a difficult task for textile finishing companies. Substances such as easy-care products, fluorocarbons for water-repellent and oil-repellent properties, various flame retardants (based on halogens or phosphors), plasticisers and solvents such as DMF have been proposed, are already restricted, or are banned by REACH. This implies that many chemicals used in textile finishing require specific attention with regard to their purchase, transport, storage, use (industrial and consumer) and end-of-life phase. In order to avoid water emissions of chemicals and to reduce energy consumption, water consumption and waste production, new reusable chemicals have been developed, which can range from formulations without water or impacting solvents to bio-based or biodegradable substances. Many of these products have been developed for other sectors and implementation in the textile sector is not always obvious (e.g. flexibility, tactile feel and resistance to washing).

The tests were carried out with products already on the market or newly introduced based on different active ingredients. The goal is to get as close as possible to the current characteristics of the product to guarantee the market characteristics such as waterproofing and rigidity that ensure manageability during cutting and shaping. The selection of the best treatments is made on the basis of the analysis of the state of the art, of the executive design and of the performance requirements and of the environmental impact, according to international regulations and certifications, such as REACh and OekoTex.

2 NEW FINISHING TEST

The goal of the deliverable is the development of new alternative finishes that can replace existing recipes in order to reduce their environmental and health impact. Mainly, the goal is to find a new formulation that avoids the use of substances considered dangerous and restricted such as formaldehyde, deriving from melamine resin and fluorocarbon resins, with the possibility of having unchanged performance on the final properties of the fabric. Finding an alternative solution to the current formulations can lead to benefits in terms of sustainability that could be added to the possible benefits of using a recycled acrylic fibre and which will be studied and published in the D6.5 - Life Cycle Environmental Assessment Report for recycled acrylic textile and comparative analysis.

In the previous D5.1 - State of art of environmentally friendly finishing, the state of the art of various emerging technologies on the market that can replace the current finishes used for sun protection and outdoor furniture was explored. Considering the chemicals to be replaced and the final performance of the fabric, a series of possible substitutes divided between water-repellent fluoro-free resin and crosslinkers based on bio-based polyurethanes.

2.1 Fluoro-free water repellent

Among the various solutions available on the market, the proposed formulation is a fluoro-free water repellent. The material identified is a highly effective waterproofer on any item and gives a water repellent effect without altering the air permeability. The formulation has excellent fastness to washing in water and good to dry cleaning. The application of the finishing does not affect the colourfastness to light and does not change the hand and the mechanical properties of the treated articles.

2.2 Polyurethane crosslinker

For this type of formulation, different products were tested with the aim of finding a good mix with the water repellent that would achieve similar performance to that of the common finishing used. The formulation is a polyurethane water-based, polyester-based, aliphatic and with the use of around 35% of raw materials from renewable sources.

2.3 Test results

The new eco-friendly alternative finishing has been tested in the laboratories on acrylic fabrics, the processing conditions have been kept unchanged compared to the finishing process with the classic finishing. The process takes place by impregnating the fabric in the finishing bath with subsequent drying.

The tests carried out with different concentrations and combinations of chemical compounds were compared with the classic finishing by means of rising pressure water column tests according to the AATCC 127 standard. The new formulation has a hydrostatic pressure of 31 cm close to the classic formulation.

The results show how the new formulation reaches values slightly lower than the common finishing, this difference can be attributed to the presence in the common finishing of the fluorocarbon resin which gives the fabric a greater water-repellent effect. The best formulations will be brought to the attention of the industrial fabric production process and will be tested during the production phase. The results of the tests on an industrial scale will be reported in D5.2 - Results of warping / weaving samples and laboratory testing – executive summary.