Advancing Safe and Sustainable Textile Materials in the Ssbd4Chem Project: Industrial Production of Virgin PET, Recycled PET (r-PET) and Bio-Based PLA Yarns

Onur ÇELEN[1], Mine Türkay KANKIRAN[1]
[1]KORTEKS A.S. , Bursa, TÜRKİYE, onur.celen@zorlu.com, *mine.turkay@zorlu.com*

AACHEN DRESDEN DENKENDORF
INTERNATIONAL **TEXTILE** CONFERENCE

INTRODUCTION & MOTIVATION

"SAFE AND SUSTAINABLE BY DESIGN FRAMEWORK FOR THE NEXT GENERATION OF CHEMICALS AND MATERIALS" Horizon Project (Grant no: 101138475) as shortly "Ssbd4Chem" brings together stakeholders from industry, government, academia, and civil society to develop and promote best practices for safe and sustainable product and process design, through demonstration in 3 case studies; automative, textile and cosmetic. The demonstrators will be the starting point for further implementation and standardisation of the new methods.

The materials/chemicals of the demonstrators include PFAS-free textile coatings and yarns in different composite materials. Screening and testing methods focus on; physicochemical characterisation with volatile organic compounds, non-uniform particles and composition of the material, as well as risk assessment with exposure and hazard assessment and in silico prediction tools to reduce experimental delay.

" Ssbd4Chem " Horizon Europe Project is the second Horizon Europe Project of KORTEKS. Basically KORTEKS contributes to safe and sustainable design of textile materials. In this scope, KORTEKS produced virgin PET, recycled PET and PLA filament yarns and different fabric samples for Pfas free plasma coating trials. In addition KORTEKS conbtributes to life cycle analysis of textile materials.

MATERIAL

Virgin PET and r-PET polymers were supplied from KORTEKS, TÜRKİYE. PLA Polymer was purchased from TOTAL CORBION, THAILAND.

METHOD

KORTEKS role in the project is to spin virgin and recycled polyester Pre-Oriented Yarn (POY) and Fully Drawn Yarn (FDY) by melt spinning process. After that, friction texturising method applied to POY to generate recycled Texturised filament yarns. Melt spinning was carried out in both in semi pilot and industrial melt spinning machine (Barmag) which can produce both POY and FDY filament yarn types with a maximum production speed of 5000 m/min with four heated godets system. Trials started with lab scale production, after confirming the lab scale production performance, industrial scale trials were carried out. In this scope, the input recycled pellets were tested chemically (viscosity, carboxyl, ash, DSC etc) and the output virgin PET, recycled PET and PLA yarns were physcially tested; tenacity (DIN 2062) , elongation at break (DIN 2062) , shrinkage (DIN 53866) and also chemically (viscosity, carboxyl, ash, DSC etc) tested. After confirming yarn properties, yarns were knitted in fluffy construction as a fabric.the fabrics were sent to other partners for plasma coating for functionalities (antibacterterial, self cleaning, hydrophicity) and for microfiber emission analyses.

RESULTS

The characterisation results of produced yarns were given in Table 1.

Table 1. Yarn Properties

Yarn Properties	Virgin PET	R-PET	PLA
Denier	100	100	100
Filament number	36	36	36
Cross Section	Round	Round	Round
Tenacity (cN/dtex)	4,12	3,74	2,27
Elongation at break (%)	22,44	25,38	26,85
Shrinkage (%, at boiling water)	0,9	0,9	6,2

CONCLUSION

Within the Ssbd4Chem project, filament yarns based on virgin PET, recycled PET and bio-based PLA were successfully produced and processed into textile fabrics suitable for functional surface treatments. The results demonstrate that recycled PET can be processed under industrial spinning conditions comparable to virgin polyester, supporting its integration into existing textile manufacturing systems. The developed fabrics are used as demonstrator materials for PFAS-free plasma coating processes that aim to provide functionalities such as antibacterial behaviour, hydrophilicity and self-cleaning properties without the use of conventional chemicals.

By combining recycled and bio-based polymers with safer surface modification techniques, the project contributes to the implementation of the Safe and Sustainable by Design (SSbD) framework. These developments support circular material use, reduce reliance on hazardous chemistries and promote more environmentally responsible textile production.

ACKNOWLEDGEMENT

This work is part of the *Ssbd4Chem* project and has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No: 101138475. The authors gratefully acknowledge the contributions of all project partners involved in the development and evaluation of safe and sustainable textile materials.

Funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement n° 101138475. UK participants in SSbD4CheM project are supported by UKRI under grant agreement n° 10110559. CH participants in SSbD4CheM project receive funding from the Swiss State Secretariat for Education, Research and Innovation (SERI). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

Project funded by UK Research and Innovation

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI