

Biophysical Concept for Textile Skin Protection – a Systematic Approach with Functionalized Man-Made Cellulosic Fibers

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Introduction

Different factors influence the human skin every day and everywhere. The factors can be categorized into physical, chemical and biological issues. Most harmful factors are difficult to avoid and can lead to accelerated skin ageing and significant skin diseases, as e.g. malignant melanoma. The exposure of radiation, especially UV radiation and infrared light to the skin must be considered because of their negative health effects on the skin. A lack of biological active substances, as e.g. Vitamin D or E, has also negative impacts on the skin. Furthermore, an improved accessibility of the biological active substances can decrease the negative effects caused by factors related to the physical and chemical categories. Aim of this project is to develop functional textiles which protect against harmful UV or IR irradiation on the one side and make a contribution to skin protection and skin care on the other side.

Factors influencing the Skin

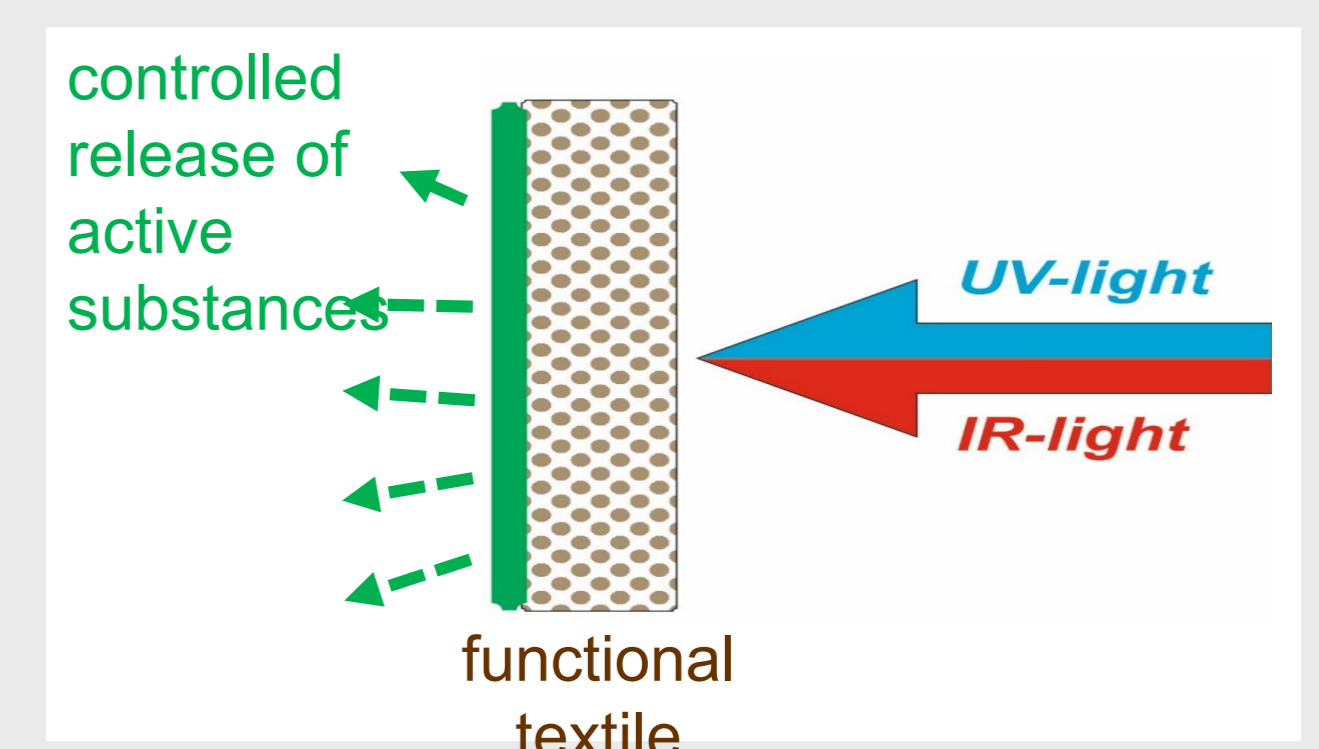
physical → radiation	UVA / UVB infrared light IRA (700-1400nm)
chemical → harmful gases, e.g. NOx; smoke	
biological → deficiency of biological active substances, e.g. vitamin D & E	

	Effects	Target Groups
Vitamin E	skin protection antioxidative regeneration of stressed skin	<ul style="list-style-type: none"> outdoor athletes outdoor worker neurodermatitis sufferers
Vitamin D	strengthens the immune system positive effect on bone stability, teeth preservation	<ul style="list-style-type: none"> children elderly people

Effects of vitamin E and D on human skin and body.

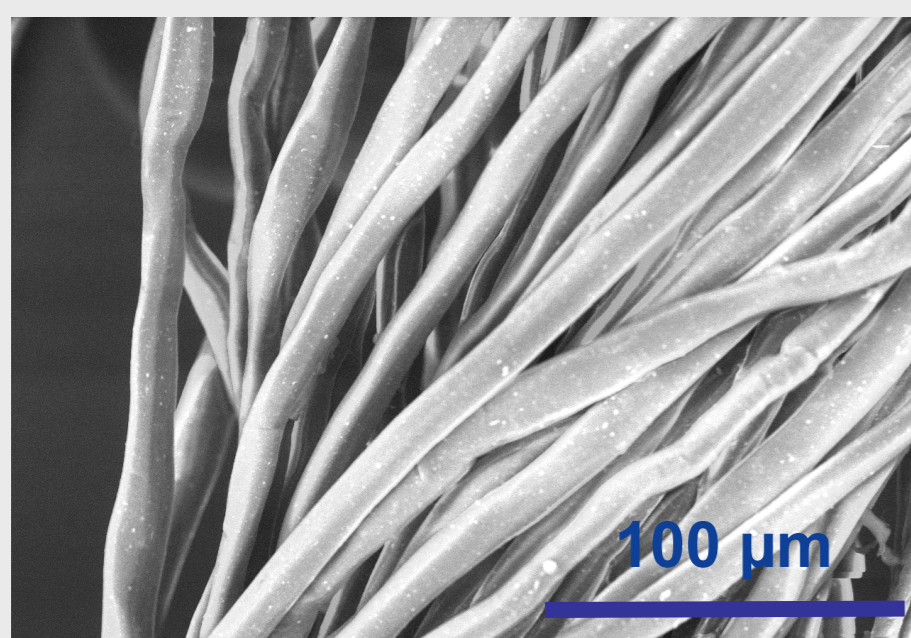
Categories and examples of harmful factors, influencing the human skin.

Systematic Approach

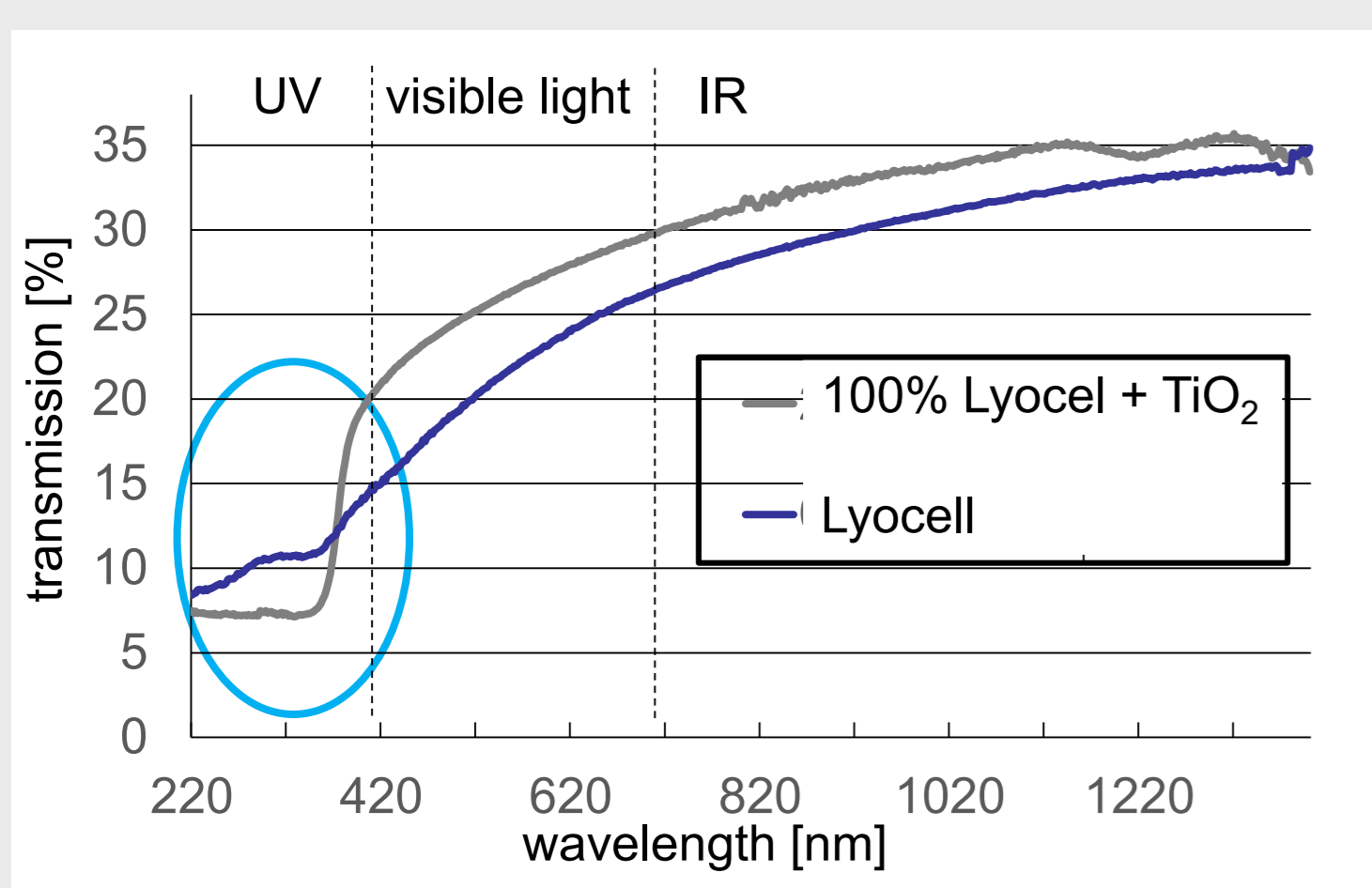


Textiles made of Lyocell fibers with embedded absorber (e.g. TiO₂) and biological active substances (e.g. vitamins) are presumed to protect against harmful irradiation and make a contribution to skin care. An optional finishing should increase the effects.

Functionalized Fibers



SEM image of Lyocell fibers containing TiO₂



➤ Functionalization of fibers with TiO₂ reduces transmission in the UV range.

Product Development



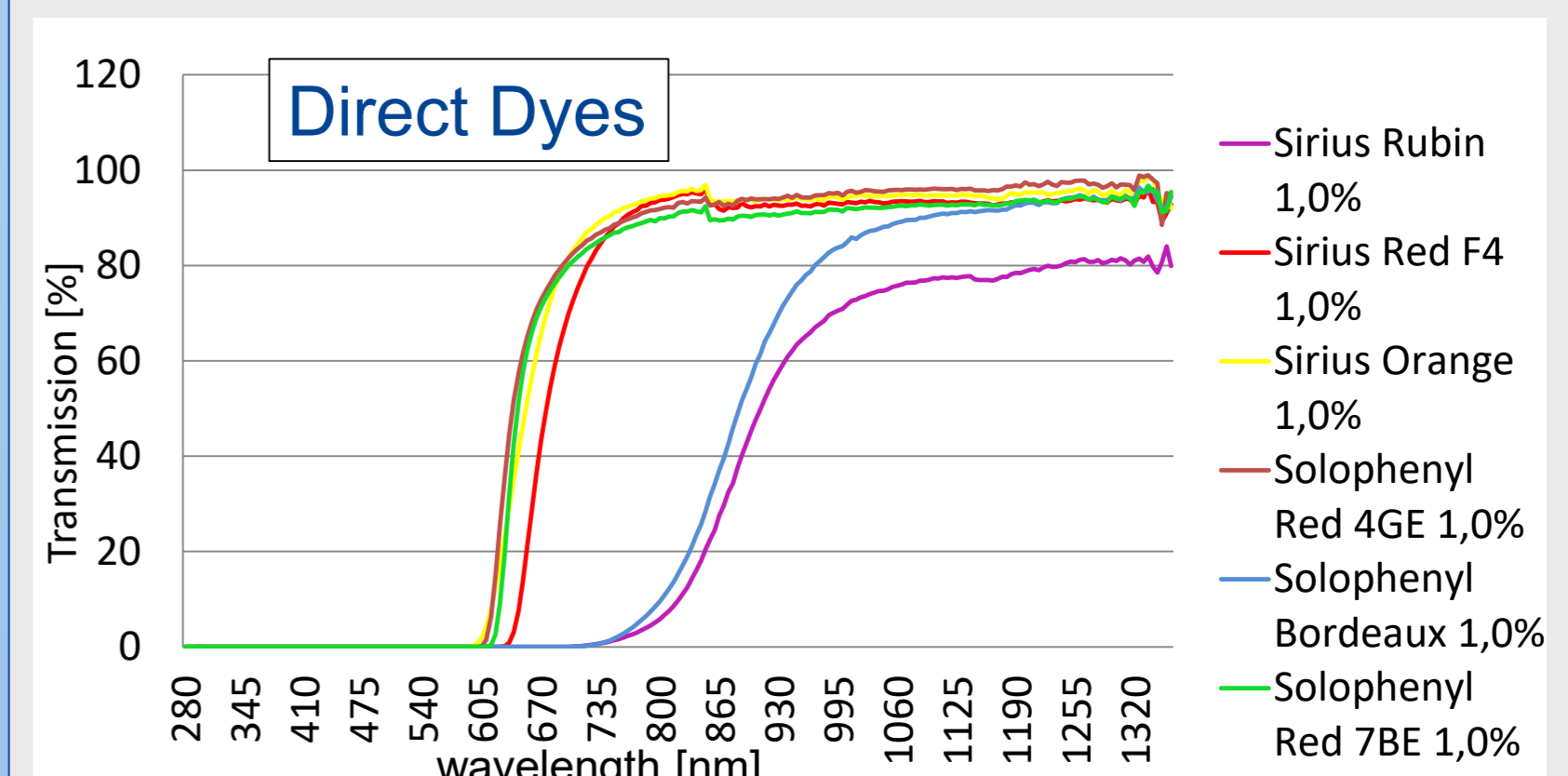
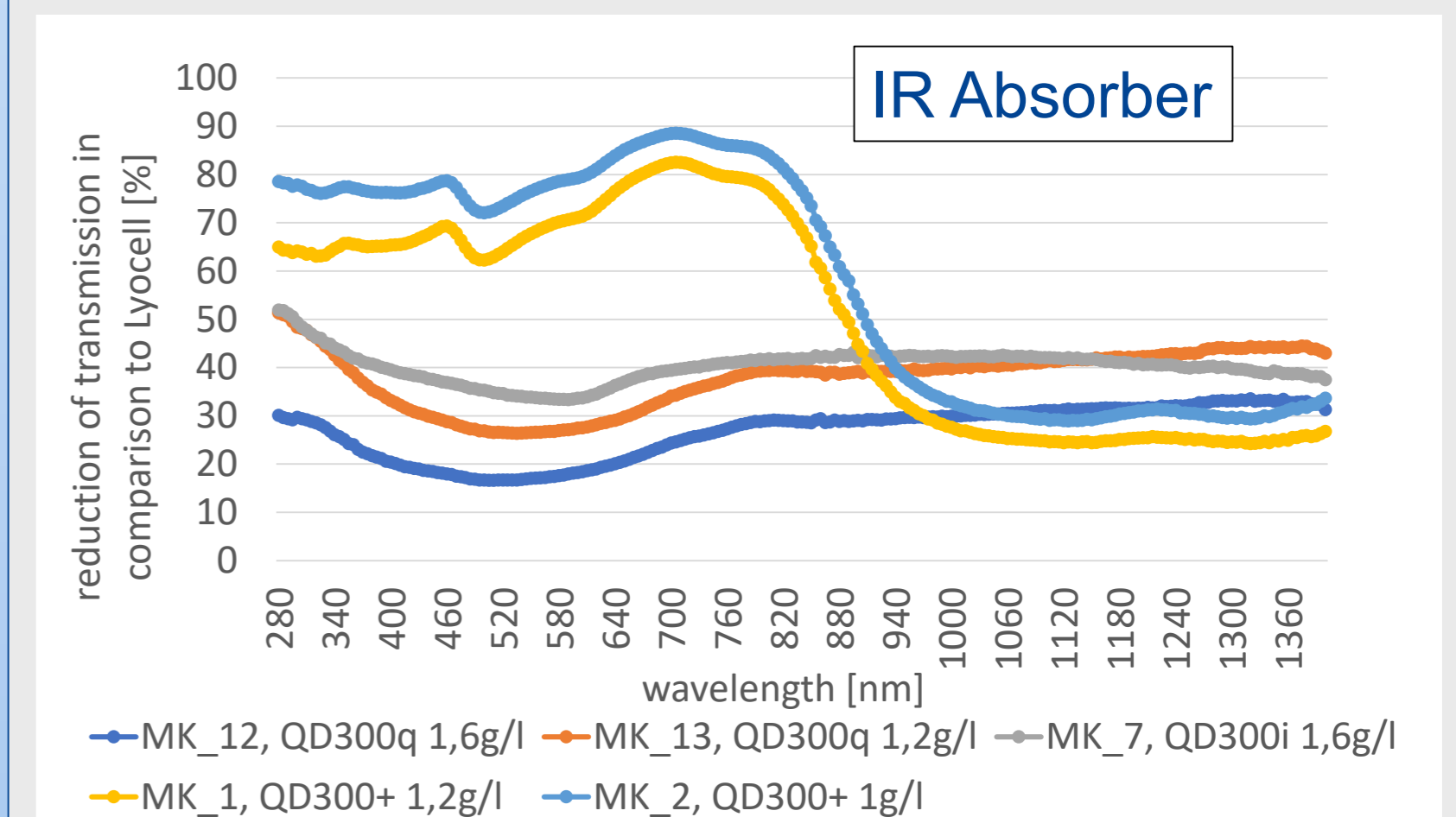
Double side textile by plated knitting technique

- low transmission of UV irradiation
- skin care by vitamins
- low pilling
- abrasion stable
- washable



Examples of knitwear from industrial partners

Functionalization and Dyeing



➤ IR absorber or dyeing reduces absorption in different wave lengths ranges

Summary

- Functionalized Lyocell fibers containing TiO₂ reduce transmission in the UV range.
- Integration of vitamins should improve the effect on skin protection and skin care.
- Combining textiles made from functionalized fibers with wet finishing processes and / or dyeing increase the protection against IR irradiation.
- Areas of application arise in the field of workwear, leisurewear, sportswear and kidswear, aimed in particular at the outdoor sector, as the physical component of radiation protection clearly comes into play for this area.
- for details see: K. Klinkhammer *et al.*, Communications in development and assembling of textile products 2022, 3 (1), 51-61. DOI 10.25367/cdatp.2022.3.p51-61.

Acknowledgment