Use of Microcrystalline Cellulose as a Matrix for Functional Coatings

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Abstract

The textile industry still relies predominantly on fossil-based polymers for finishing and coating applications. Microcrystalline cellulose (MCC), derived from wood pulp, represents a promising renewable alternative. This study aimed to develop a water and cellulose-based coating system with high wash durability and to evaluate its suitability as a matrix for functional additives.
Commercially available water-dispersible microcrystalline cellulose gels (MCGs) were characterized by rheological measurements and optimized for application using conventional textile finishing equipment. MCGs refer to synergistic, co-processed composites consisting of MCC and sodium carboxymethylcellulose (Na-CMC). Crosslinking strategies were developed to meet the requirements for wash fastness. To impart new properties to the fabric, selected functional additives were investigated such as phase change materials, invisible UV phosphors, fluorescent and other color pigments, UV and NIR absorbers and AGXX particles.
The developed technology enabled the formation of stable cellulose coatings with good wash durability on textile substrates. Special crosslinkers were identified as particularly suitable for achieving permanent coating performance. Furthermore, the cellulose layers allowed the stable incorporation of a wide variety of functional additives and color pigments underlining their potential as a sustainable replacement for fossil-based textile coating materials. These functionalities open up a wide range of applications, including thermoregulatory and protective clothing, UV- and NIR-shielding textiles, antimicrobial medical and hygiene products, UV-activated and security related textile features, fluorescent safety textiles or multifunctional smart textiles combining several of these properties.

Keywords: Microcrystalline cellulose (MCC), cellulose based textile coatings, wash durability, crosslinking, functional additives, sustainable textiles.

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