Microscopic Features Influences on Textile Fabrics Self-Cleaning Ability

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Abstract: Self-cleaning ability in textile fabrics was comprehensively investigated in the last decade. Most of these investigations have used surface roughness, and low surface energy features to establish a self-cleaning mechanism. Extensive research articles and reviews have been published to describe these processes along with their microscopic features. When these reviewed with a critical eye, it has been found that a comprehensive effort is still required to compile all these previous research, emphasizing how textile fabrics’ microscopic features can influence their self-cleaning ability. No research has been conducted to explore the self-cleaning potential of microscopic geometrical features of fabric at the woven structural level. Researchers used microscopic features to increase the mechanical strength of the fabric. However, they did not change the microscopic features at a woven level to evaluate the self-cleaning ability. In the existing literature, researchers have tried to develop self-cleaning textiles with the help of coatings on the fabric. These coatings are applied to the fabrics by using spray and nanoparticle processing. The coatings create a different surface on the fabric, and hence the changes in the microscopic features of this surface control the self-cleaning ability. Instead of using an additional coating, the microscopic features of the fabric itself can also influence the surface roughness and low surface energy and provide self-cleaning ability at the woven structural level. Key microscopic features like surface roughness, porosity, and wettability of a textile fabric are still not comprehensively investigated for their influence on fabric’s self-cleaning ability. Significantly, the interdependencies between these features with overall fabric geometry at the woven level have not been explored quantitatively. Qualitative observations have been made mainly in the past literature. However, fabrics with self-cleaning ability to be produced in mass production require extensive empirical studies. These studies must involve parametric analysis on varying values of the microscopic features and their quantitative influence on the desired self-cleaning feature.

Keywords: self-cleaning ability, influence, microscopic features, textile fabrics

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