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RECENT ADVANCES IN FUNCTIONAL TEXTILES- AN OVERVIEW

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ABSTRACT

The growing demand for multifunctional and sustainable textiles has led to a surge in research integrating nanotechnology into fabric systems. This review explores recent advancements in nanotechnology-enabled textiles, focusing on three core functionalities: electromagnetic interference (EMI) shielding, self-cleaning, and aroma-releasing properties. With increased environmental awareness and the rise in smart device usage, textile-based EMI shielding using metallic nanoparticles like silver and copper has become essential. Simultaneously, photocatalytic nanoparticles such as TiO_2 and ZnO provide durable self-cleaning effects, while silver and herbal-based antimicrobials offer eco-conscious hygiene solutions. Aroma-releasing textiles, enhanced through Nano- or micro-encapsulation of essential oils, show promise in wellness and cosmeto-textile applications. The review identifies key research gaps, including the need for standardized testing protocols, long-term safety assessments, and scalable, cost-efficient production methods. Current trends reveal a shift toward green synthesis, biodegradable carriers, and plant-based functional agents. The study also highlights real-world applications across healthcare, defense, sportswear, and therapeutic fashion. Looking forward, smart textiles combining sensory technology, AI-driven design, and sustainable nanomaterials represent a transformative direction for the industry. This paper underscores the importance of interdisciplinary collaboration to translate laboratory innovations into practical, commercially viable products that align performance with sustainability.

KEYWORDS: *Nanotechnology, Electromagnetic Radiation Shielding, Self-Cleaning Fabric, Textile Nano finishes, Aroma Finishing, Metal Nanoparticles*