

EFFECTS OF NANOSILVER APPLICATION ON PHYSICAL, MECHANICAL AND ANTIBACTERIAL PROPERTIES OF COTTON FABRICS

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Silver nanoparticles are often applied to textiles for their strong antimicrobial activity. Textiles have been treated primarily with silver nanoparticles by blending them with textiles, which is called the *ex-situ* method, and by synthesizing silver nanoparticles in the textile sometimes using intrinsic properties of the textile, which is called the *in-situ* method. The influence of *ex-situ* and *in-situ* silver nanoparticle treatment methods related to comfort and performance properties of textiles has been only scantily investigated. The opportunity therefore exists to identify a durable and economical approach to apply silver nanoparticles on cotton fabrics with minimum alterations to physical and mechanical properties of the treated fabrics employing the *ex-situ* and *in-situ* methods.

An existing *ex-situ* chemical method and an *in-situ* photo-reduction method developed in our research technology to treat silver nanoparticles on cotton fabrics were investigated. AgNO_3 was the silver source in both methods. In the *ex-situ* method, a nanosilver colloid was prepared using trisodium citrate which acted as a reducing and a stabilizing agent. This nanosilver colloid was applied on fabrics using the pad-dry-cure method. In the *in-situ* photo-reduction method, nanosilver was synthesized in cotton fabrics using cellulose as the reactor and the stabilizer in the presence of ultraviolet radiation. The antibacterial, performance and comfort properties of the nanosilver treated fabrics were compared with those of the untreated fabrics. The rigor of the research was improved by statistically comparing the results.

Results indicated that the *in-situ* nanosilver treated fabrics could retain its performance properties close to the original fabric. Further, it is also evident that this method is environmentally benign due to the less complex finishing process, low chemical usage and low leaching out of silver in the washing process. The ability to control the size, place or shape of application of nanosilver on cotton makes the *in-situ* method more adoptable for various textile usages. The *ex-situ* method indicated its inability to retain treatment durability and alterations were observed in the performance properties with the introduction of silver nanoparticles to the fabric. Methodology presented here to study the effects of nanosilver treatment on textiles could be of interest to other nanoparticle applications.