



Simultaneous in situ synthesis of nano silver and wool fiber fineness enhancement using sulphur based reducing agents

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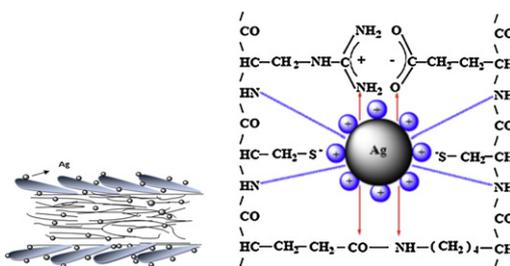
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HIGHLIGHTS

- ▶ In situ synthesis of nano silver on wool.
- ▶ Comparing two sulphur based reducing agents for nano silver synthesis on wool.
- ▶ Enhanced wool fineness through extension of yarn with help of reducing agent.
- ▶ Improved wool fiber tensile strength through in situ synthesis of nano silver.
- ▶ Combining production of fine wool with antibacterial finishing.

GRAPHICAL ABSTRACT



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ABSTRACT

Due to the special properties of nano particles for applications in textile processing and concern of wool fineness, a novel method is introduced in this research to modify the coarse wool fineness along with synthesis of nano silver to impart antibacterial properties on wool. Moreover, two diverse reducing agents with various concentrations are employed with different concentrations of silver nitrate solutions. The ability of both reducing agents confirmed in synthesizing nano silver on the coarse wool through drawing process producing fine wool fibers. However, comparing these two sulphur-based reducing agents; the finer wool fibers obtained by using sodium dithionite. Interestingly despite our expectations, the tensile strength of the fine wool yarns increased, using both reducing agents along with silver nitrate. FTIR analysis confirmed the changes in the protein structure of the wool and XRD, EDX, AAS and SEM and proved the synthesis and loading of nano silver particles on the wool fiber surfaces. Further, the antibacterial properties of the fine wool confirmed through testing with two different bacteria, including *Staphylococcus aureus* as a Gram positive and *Escherichia coli* as a Gram negative bacteria.

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1. Introduction

Silver and its compounds have been studied for many years, not only for their antibacterial activity, but also for their low

toxicity [1–8]. Various methods employed for nano silver synthesis, including photo-catalytic reduction [9,10], chemical reduction [11] photo-chemical or radiation-chemical reduction, metallic wire explosion, sono-chemical, polyols [12], matrix chemistry [13], photo-reduction [14], reverse micelle based methods [15] and even biological synthesized [16–20].

Silver ions attach to sulfhydryl, amino, imidazole, phosphate and carboxyl groups of proteins [21]. Kumar et al. proposed bonding formed via reaction between silver in oxide form and sulfhydryl (–S–H) groups [21].

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