Nano-Structures & Nano-Objects 22 (2020) 100425

Contents lists available at ScienceDirect

Nano-Structures & Nano-Objects

journal homepage: www.elsevier.com/locate/nanoso

# Eco-friendly Packaging Composite Fabrics based on in situ synthesized Silver nanoparticles (AgNPs) & treatment with Chitosan and/or Date seed extract

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ARTICLE INFO

*Article history:*
Received 12 June 2019
Received in revised form 4 November 2019
Accepted 20 January 2020

*Keywords:*
Packaging
Eco-friendly
Chitosan
Silver nanoparticles
Date extracts

ABSTRACT

This research was based on the preparation and treatment of raw cotton fabrics with nanoparticles and date seed extract/chitosan at the same time and in a single treatment bath in an easy and modern manner. The date seed extract and chitosan were used in the treatment bath to increase the functional properties of these fabrics. Tests were performed for the resulting fabrics such as air permeability, water absorbance, tensile strength, Scanning electron microscope (SEM), X-ray Diffraction (XRD) and antimicrobial activity for four types of microbes such as gram negative (*Pseudomonas aerugenosa*), gram positive (*S. aureus*), fungi (*A. niger*) and yeast (*C. albicans*). The results showed that raw fabrics treated with silver nitrate in the presence of chitosan and date seed extract gave the best result for resistance to microbes and this led to increased air permeability and water absorbance. From the above, these fabrics can be used in the various packaging process such as packaging of seeds and powder materials.

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## 1. Introduction

There is tremendous research for improvement of nanocomposite materials for applications in packaging especially for food packaging. Various new polymeric materials and composites with metallic nanoparticles are nowadays used for their commercial applications in packaging [1–3]. Chitosan has been reported, as a potential polymeric material for food packaging, especially as edible films and coatings due to its excellent film forming properties. Owing to reactive amino and hydroxyl functional groups, chitosan is frequently blended with other polymers or cross-linked (such as guar gum) to improve their functional properties such as antimicrobial activity [4–6]. Composite films obtained from chitosan and guar gum might decrease environmental problems as compared to synthetic packaging. There are many researchers used some plant extracts such as Conocarpus erectus extract for fabrics treatment to make antimicrobial fabrics [7]. The aqueous extract of *Conocarpus erectus L*, was found to be rich in tannins, flavonoids and other phenolics. It appears with good inhibitory activity against all tested Gram positive bacteria with zones of inhibition range from 11 to 15 mm at 2000 μg concentration. The appropriateness of wool and nylon fabrics with *Conocarpus erectus L.* extract using pigment printing technique is also being seen. Printed fabrics have antibacterial activity especially against Staphylococcus aureus. Recently, nanomaterial such as silver, gold and zinc oxide has achieved great interest and as a result their wide applications in many novel technologies, such as electronics, chemistry, medicine and other biotechnological approaches [8–10]. Synthesis of nanoparticles by polyvinyl alcohol was displayed as easy method for nanometal particles [11]. Silver nanoparticles were prepared in an easy and simple manner (50–3500 ppm) by using polyvinyl alcohol (PVA) as a stabilizer for nanoparticles and sodium borate as a reducing agent under certain conditions. The prepared fabrics were treated with nanoparticles at different concentrations (50–3500 ppm) at room temperature. The treated fabrics have a good resistance to bacterial growth (Gm+ve & Gm-ve). The use of biodegradable carbohydrates for the synthesis of nanosized material was appeared as a new approach for the synthesis of metal nanoparticles [12–15]. The metal nanoparticles were prepared (500 ppm concentration) in presence of hydroxypropyl starch (HPS) as an oxidation agent for silver nitrate solution and at the same time, it was used as a stabilizer for nanoparticle by the following conditions, pH of the reaction 12, hydroxypropyl starch concentration 0.9 g/l, concentration of silver nitrate 0.078 g/l. This reaction takes place at 70 °C for 15 min. The fabrics were treated with nanoparticles at different concentrations (50&100 ppm) at room temperature in

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https://doi.org/10.1016/j.nanoso.2020.100425
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