Antibacterial finishing on textile goods by nano silver colloid

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Introduction

In recent years demand for antibacterial and deodorizing fabric sharply has growth due to increase of sickness types . nano silver colloid synthesis in manner of down to up has done with different solvent such as ethanol , water , DMAC and MEG . Effect of solvent type on the particles size distribution and structure of them was evaluated . atomic force microscopy has been used for determination of particles size distribution and structure . MIC and MBC values has determined for all of colloids to particle size influence on bactericide . this colloids was prepared in different concentration and following , finishing on cotton , wool , pet and blend fabrics has be done in manner of pad – dry –cure . antibacterial tests was established in accordance with antibiogram disk test method . scanning electron microscopy were used to observe surface morphologies of fabrics and nano particles . irritancy sensitive testing were done in accordance with draize protocol in forms of wet and dry . the get results were show that solvent type has very effective on particle size distribution as with increasing viscosity of solvent , decrease particle size and in like manner increase power of colloidal bactericide. at last , this finishing don't show any sensitive on rabbit skin .

Aim

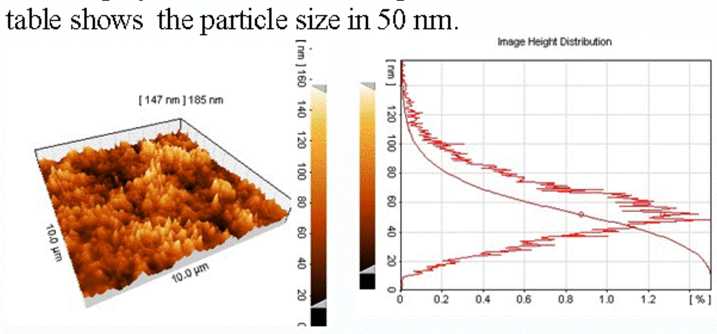
- Investigation of solvent type effects on particle size distribution .
- Investigation of solvent viscosity effects on particle size distribution .
- Evaluation of Particle size distribution effects on MIC , MBC values (power of bactericide).
- Determination of affective concentration for using.
- Investigation of particle size effects on textile colour.
- Investigation of nanosilver irritancy effects on rabbit skin (accordance with Draize protocol) .

Methods

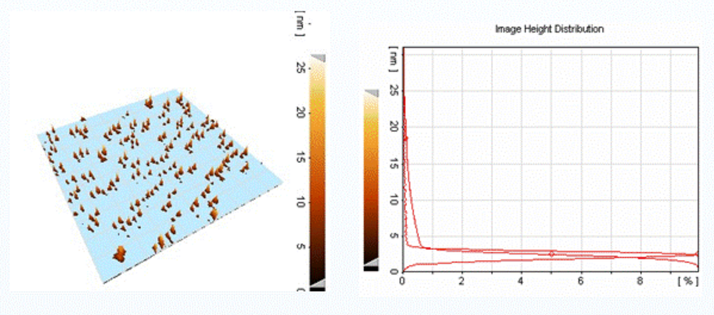
Firstly , nanosilver colloid produces from reduction of silver nitrate (AgNO3) in different solvents such as water , ethanol , dimethyl acetamide (DMAC) , mono ethylene glycol (MEG) with a optimum concentration of surfactant . MIC and MBC measuring done on negative and positive gram so that prepared different concentration of nanosilver colloid (from 0.25 to 256 ppm) then for each tube add bacteria's in about 10^6 cfu/ml . All tubes were placed in incubator for 18 hrs at 35°C so sampling from transparent tube do on muller hinton agar pales for determination of MBC values and again places in incubator . The Solution prepared for dipping fabric with different concentration of nanosilver , water and isopropyl alcohol as wetting agent . All fabrics dip in this solution and then padding and curing . Treatment fabrics for evaluation of zone inhibition values were placed in bacteria plates . Finally , irritancy testing has done in accordance with Draize protocol as that fabrics dressing on rabbit skin .then use normal saline contained of cmc for negative control and histamine hydro chloride (2%) for positive control and following it evaluated erythema and edema values .

Results

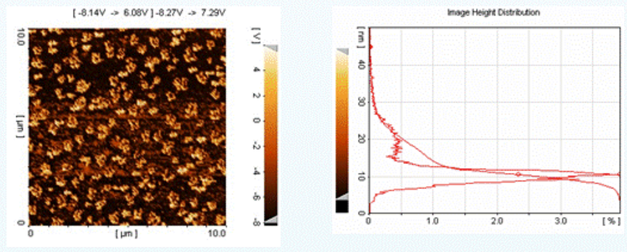
The shapes display the topology of particles and particle size distribution in aqua's solvents. because of the high concentration in test time , the image of the surface have been displayed continuous . The particle size distribution table shows the particle size in 50 nm.



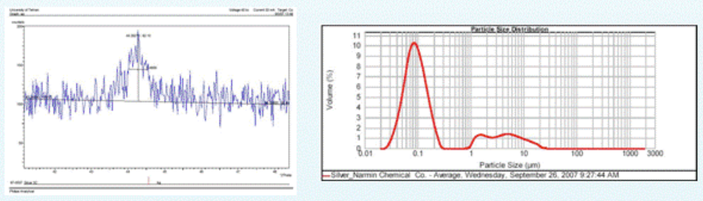
Because the viscosity of the MEG is high , particle size distribution is so homogeneous and about 3nm



The atomic force microscope image shows octagonal structure for nanosilver . The particle size distribution is about 10nm. Because the solvent is polar .



The images of XRD , DLS display particle size distribution for Dimethylacetamide therefore this results report that particle size distribution is function of the viscosity and solvent type .



This table displays the results of all microscopic test . Amount of MIC and MBC have been collected for all of the collides and five type of negative gram and positive gram bacteria's with 10^8 cfu/ml. This results shows that amount of kill bacteria for 1mec is more than all . therefore amount MIC and MBC is function of particle size .

Bacteria Type	Ppm / ml	256		128		64		32		16		8		4		2		1		0.5		0.2	
	Solvent Type	I	B	I	B	I	B	I	B	I	B	I	B	I	B	I	B	I	B	I	B	I	B
Staphylococcous Aureus H	Water	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	MEG																						
	ETOH																						
	DMAC	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
Staphylococcous Aureus st	Water																						
	MEG	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
	ETOH	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	DMAC	-	-	-	-	-	+	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+
Pseudomonas	Water	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	MEG																						
	ETOH																						
	DMAC	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
Escherichia coli	Water	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	MEG	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+
	ETOH	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
	DMAC	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
Klebsiella pneumoniae	Water	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	MEG	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
	ETOH	-	-	-	-	-	-	-	-	-	+	-	+	+	+	+	+	+	+	+	+	+	+
	DMAC																						

Amount of sensivity have been detected with Anti Biogram Disk method on treatment fabric .This table shows amount of Zone Inbibition for different concentrations of collids for all fabrics

sample	Cotton			Wool	
bacteria	80	160	300	160	300
Staph.aureus	-	2 mm	2 mm	-	3.5 mm
klebsiella	-	3 mm	3 mm	-	3 mm
E.Coli	-	2.5 mm	2.5 mm	-	3 mm

Finally irritarey sensivity tests carried out according to draize protocol. Anti bacterial fabrics in dried type and wet type had spent on the rabbit skin .This table reorts results for 72 hours .

Animal No.	Observation 4 hrs	Observation 24 hrs	Observation 48 hrs	Observation 72 hrs	Negative Control	Positive Control
1	Er - Ed -	Er + Ed -	Er - Ed -	Er - Ed -	Er - Ed -	**Er** ++++ **Ed** ++++
2	Er - Ed -	Er - Ed -	Er - Ed -	Er - Ed -	Er - Ed -	**Er** ++++ **Ed** ++++
3	Er - Ed -	Er - Ed -	Er - Ed -	Er - Ed -	Er - Ed -	**Er** +++ **Ed** +++
4	Er - Ed -	Er - Ed -	Er + Ed -	Er - Ed -	Er - Ed -	**Er** +++ **Ed** ++++

Animal No.	Observation 4 hrs	Observation 24 hrs	Observation 48 hrs	Observation 72 hrs	Negative Control	Positive Control
1	Er - Ed -	Er - Ed -	Er - Ed -	Er - Ed -	Er - Ed -	**Er** +++ **Ed** ++++
2	Er - Ed -	Er - Ed -	Er - Ed -	Er - Ed -	Er - Ed -	**Er** ++++ **Ed** ++++
3	Er - Ed -	Er + Ed -	Er - Ed -	Er - Ed -	Er - Ed -	**Er** ++++ **Ed** +++
4	Er - Ed -	Er - Ed -	Er + Ed -	Er - Ed -	Er - Ed -	**Er** +++ **Ed** ++++

The results of the experiments reports to present neither Er nor ET therefore this results dose not cause sensivity in animals .

Conclusion

- Particle size distribution is dependence on viscosity and polarity of solvent
- MIC (minimum inhibitor concentration) and MBC (minimum bactericide concentration) are dependence on particle size distribution .
- Finishing of fabric with nanosilver colloid could be manufacturer antibacterial properties .
- Fabric Treatment with nanosilver colloid to reach be antibacterial property don't cause irritancy .

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