DURABLE BACTERICIDAL SURGICAL GAUZE

A. GHOSE

Defence Science Laboratory, Delhi

RENU SENGUPTA

Defence Research Laboratory (Materials), Kanpur

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Simpler methods of treatment to impart high bacteric idal, non-toxic properties to surgical gauzes as well as their stability during storage have been envisaged. The method under reference (Institute Textile, 1963), covered by a patent, has also been explored.

Wash resistant bactericidal property has been claimed for fabric treated with silver dimethylol-propylene thiouranium nitrate[1] and also with ethylene thiourea and silver nitrate[2]. Similar property has been reported in cellulosic materials oxidised and treated with $H_2.N.NH.C.(X).NH_2$, where X is oxygen or sulphur and a metal ion like copper, silver, cobalt, nickel or iron[3].

METHODS OF TREATMENT ON SURGICAL GAUZE

Sample 1(*a*)—Thiourea (7·6 g) is dissolved in a minimum quantity of water, 40 per cent formalin (100 ml) is added to it and the volume is made to 1 litre. It is then heated on a water bath to half its volume when a clear solution is obtained. The gauze sample is impregnated with this solution overnight, dried in air and kept in vacuum for 2 hours to remove excess of formaldehyde. The dried sample is then dipped in 3 percent silver nitrate solution for 15-20 minutes, squeezed, dried in air and baked at 110°C for half an hour.

Sample 1(*b*)—The gauze sample is impregnated in a solution (thiourea, 0·76 g; silver nitrate, 0·11—0. 22 g; water 50 ml) for 30 minutes, squeezed and dried in air. The dried sample is then dipped in 8 percent formalin for 5 minutes, squeezed, air dried and baked at 110°C for half an hour.

Sample 2—Same treatment as in sample 1(a), except that silver nitrate is replaced with a 3 per cent solution of zinc chloride.

Sample 3—The gauze sample is treated with 0·1M sodium metaperiodate solution for half an hour in the dark, washed thoroughly first with running water and then with distilled water. The sample is then dipped in a 10 percent solution of semithiocarbazide for 24 hours, dried in air and finally dipped in 1 percent solution of copper sulphate for 2 hours and dried in air.

Sample 4—The gauze sample is treated with sodium metaperiodate (0·01M), kept overnight and washed as in sample 3 and then dipped in 3 percent silver nitrate solution for half an hour and finally dried in air.

WASHING PROCEDURE

Sample 1(a), 1(b) and 2 were washed for 15 minutes with constant stirring at 60°C in an excess of soap solution (soap 5 gm; water 1 litre) and then in tap water. Samples 3 and 4 were washed in a similar way, with the addition of 1g. sodium carbonate in the soap solution. This more drastic treatment is especially intended to check their durable bactericidal activity.

EVALUATION OF BACTERICIDAL ACTIVITY

(*a*) Bactericidal property was assessed in all samples against the following bacteria species, *viz. Staph. aureus, Bacillus subtilis, E. coli* and *Pseudomonas aeruginosa*. For sample 1(a) activity against *Staph. albus, Streptococcus faecalis* and for sample 4 activity against *Staph. albus, B. typhosus* and *Pseudomonas pyocyanea* were also studied. Agar plate method was used for studying the extent of bacterial growth inhibition on incubation at 37°C for 24 hours[4]. The rating system was as follows :

Visual inhibition	*Percent inhibition*
Excellant	100
Good	75
Fair	50
Poor	25
Nil	0

In cases where rating was not clear intermediate numbers have been used. Such rating system has been used[5] for expressing the assessment of antimicrobial activity in fabrics.

(*b*) In case of sample 4 (washed) sterility test was carried out after six months of ordinary storage in room conditions. The sample was dipped in sterile nutrient bath and incubated at 37°C for seven days.

Bactericidal activities of the different samples are given in Table 1. Sample 4 was found to be in sterile condition as the nutrient broth was perfectly clear till 8 days observation period.

It is evident from Table 1, the gauze samples treated by methods 1(a) and 4 are highly bactericidal and wash-resistant. The bactericidal property of the latter remains totally unimpaired even after six months of ordinary storage; the effectivity of the former, however, diminishes to a certain extent. Sample 4 was found to be in sterile condition after six months of storage. Highly wash-resistant bactericidal property of sample 4 and 1(a) gives the advantage of using them more than once after washing, if necessary. The chances that these washed gauzes will be non-toxic are attributed to the following reasons :

(*i*) The highly wash-resistant bactericidal property induces little probability of absorption/adsorption of the treated chemicals in the living tissue in appreciabe amount. Silver compounds are non-toxic in low doses.

(*ii*) No untoward effect was observed when treated gauzes were stuck on wound artificially produced on the back of albino rats, for 48 hours.

(iii) No irritation effect was produced by keeping the gauzes in contact with human skin for 24 hours.

The drawback of these samples is their colour and low bursting strength (55 per cent of the control value). Attempts have been made to improve the bursting strength by impregnating the gauze samples as in 1(a) in an almost neutral solution of silver nitrate and thiourea formaldehyde resin. The resulting samples show high bursting strength but no bactericidal property. Attempts have also been made to improve the colour of the treated gauze by replacing silver nitrate with zinc chloride (Sample 2). The colour obtained was white with high bactericidal property but the wash-resistance was extremely poor. The bursting strength of the treated sample was high. Suitability of this sample for use as ready-to-use surgical gauze needs further study specially from toxicity point of view. Sample 1(a) also possessed white colour and high bursting strength. But it showed very mild bactericidal property and poor wash-resistance with virtually no prospect of being utilised as bactericidal gauze. It is worth-while to note here that gauze sample prepared by treating with only 3 percent zinc chloride or 3 percent silver nitrate solution possess very poor bactericidal activity.

The good bactericidal activity except for *S. aureus*, as exhibited by sample 3 (washed) seems promising and its possible uses in preparing bactericidal clothing can be explored.

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TABLE 1

BACTERICIDAL ACTIVITY OF THE GAUZE SAMPLES

Sample No.	Washing State	Colour	*Staph. aureus* (%)	*Bacillus subtilis* (%)	*Pseudomonas aeruginosa* (%)	*E. coli* (%)	*Staph. albus* (%)	*Staph. faecalis* (%)	*Bescillus typhosus* (%)	*Pseudomonas pyocyanea* (%)
1(a)	Unwashed	Dark brown	100	100	85	100	—	—	—	—
	Washed	Do.	85	75	70	75	70	70	—	—
1(b)	Unwashed	White	25	25	70	25	—	—	—	—
	Washed	Light brown	0	0	0	0	—	—	—	—
2	Unwashed	White	90	100	75	75	—	—	—	—
	Washed	Do.	0	0	0	0	—	—	—	—
3	Washed	Light brown	25	50	70	70	—	—	—	—
4	Unwashed	Dark brown	100	100	85	100	—	—	—	—
	Washed	Do.	85	100	60	100	85	—	75	90

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