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BACTERIOSTATIC AND BACTERICIDAL EFFECTS OF TWO COMMONLY USED DISINFECTANTS

(With 3 Tables)

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تأثير نوعين من المطهرات الشائعة الإستعمال
على البكتريـــا

صائب نظمـــى النخـــــن

فحص تأثير فعل كل من السيبتول واللايزول المطهر على خمسة أنواع من الجراثيم والــتى غالباً ماتسبب مشاكل في مجال الطب البيطري أو الصحة العامة ، وذلك بإستخدام تجربــة التخفيف وتجربة التعليق وكذلك تجربة حامل الجراثيم · ولقد تراوحت التراكيز الكابحــة للجراثيم لهذين المطهرين مابين 0.06% وبين 0.25% ، بينما كانت التراكيز القاتلــة تتراوح مابين ١٪ بعد دقيقتين وبين 0.1% بعد ثلاثين دقيقة من زمن التفاعل · أن تطهــير حاملى الجراثيم من الألمونيوم والسيراميك تم بتراكيز تتراوح بين 5% وبين 0.5% بعــد تعريضها للمطهرين لمدة 15% دقيقة وكذلك 120 دقيقة على التوالى ، ولكن تطهير حامــل الجراثيم من الخشب إحتاج إلى تراكيز أدنى وهى 2.5% وكذلك 0.5% بعد تعريضه لهاتــين الفترتين ·

SUMMARY

The effect of the septol and lysol disinfectants on five bacterial species commonly encountered in veterinary and public health problems were examined by dilution, suspension and germ carrier tests. Their bacteriostatic concentrations fluctuated from 0.06 to 0.25% while the bactericidal ones were ranging from 1% after 2 minutes interaction time to 0.1% after 30 minutes. They could decontaminate the aluminium and ceramic germ carriers by 5% and 0.5% concentrations after an exposure of 15-120 minutes, respectively, but decontamination of the wood germ carrier needed lower concentrations of 2.5% and 0.5% after elapsing these intervals.

INTRODUCTION

Disinfection is one of the essential hygienic measures in controlling the spread of infectious diseases, denaturation of products and prevention of microbial environmental pollutions. Although voluminous information about the different groups of disinfectants has been accumulated since the time of the known english surgon Lister, suitable definition of the process of disinfection is still under debate (BOSENBERG, 1970; BOSENBERG, 1971; HABS, 1970). However, various techniques were modified to achieve better and closer understanding (MATILA, 1987, ANON, 1980 b).

The misuse of the disinfectants and the subsequent ineffecient disinfection processes is predectable especially in the different aspects of life activities (DIXON, et al. 1976, RUTALA and COLE, 1984). This is linked with different variables which interfer with the reactants (GELINAS and GOULET, 1983 b, ANON, 1980 b) and subsequently reflected on the productivity and/or on the hygienic status in general. The purpose of this work is to evaluate the septol and lysol as one the commonly used disinfectants in order to detect the proper choice that should be particularly applied.

MATERIAL and METHODS

The Staphylococcus aureus ATCC 6538, Escherichia coli ATCC 11229, Proteus vulgaris ATCC 14153, Pseudomonas aeruginosa ATCC 15442 and Bacillus cereus ATCC 11778 were utilized to conduct the experiments. The optical density of 16 hour old culture of each strain was measured photometrically and adjusted to give a viable bacterial count of 10^8-10^9/ml.

The disinfecting action of Septol (chlorxylenol) and lysol (cresol 0.3%) was carried out according to the standards of the Deutsche Geselschaft fur Hygiene und Mikrobiologie (DGHM. 1969; 1981) and entailed the following:

DILUTION TEST:

The disinfectants were serially diluted (twofold) starting with a 5% concentration. Aligotes of 5 ml of each dilution and double concentrated nutrient broth (Oxoid) were thoroughly mixed and inoculated with one drop of a 1:10 diluted bacterial suspensions and then incubated at 37 C for 4 days.

SUSPENSION TEST:

0.1 ml of the bacterial suspension was thoroughly mixed with 10 ml of 5%; 2.5%; 2%; 1%; 0.1%; 0.05%; 0.02%; 0.01%; 0.005%; 0.001% concentrations of each disinfectants and were kept to interact for 2, 5, 15 and 30 minutes. After each interval had elapsed, a loopful (4 mm diameter) was inoculated into 10 ml nutrient broth and incubated at 37 C for 4 days.

GERM CARRIER TEST:

Sterile pieces of wood, aluminium and ceramic (18x4x4 mm) were dipped in the bacterial suspensions for 20 seconds. After that they were soaked for 2 minutes in 5%; 2.5%; 1%; 0.5% concentrations of each disinfectant and lefted to interact for 15, 30, 60 and 120 minutes. The pieces were then transfered into 10 ml of nutrient broth and incubated at 37 C for 4 days.

Each experiment was conducted three times taking in consideration the inactivation of the carried traces of the disinfectant with supplementation of 1% Tween 80 and 0.1% of histidin where it is needed (KIRPAL, 1973). At the same time, pure crystalline phenol and formalin (DAB 7) were used as control.

RESULTS

The spore forming Bacillus species was found to be resistant to the highest applied concentration (5%) of the both disinfectants. Their bacteriostatic effects in the dilution test are shown in table (1) where their minimum inhibitory concentration (reciprocal inhibitory value) MIC (RIV) including the control phenol fluctuated between 0.06% (1660) and 0.25% (400). On the other side, table (2) shows their bactericidal effects in correlation with the time factor by conduction the suspension test. It is clearly evident from this table that 1% of both disinfectants was effective against all the utilized bacterial species within 2 min. except Proteus vulgaris on which 2% of lysol was needed within this fime. However, by longer exposure time, as it is predected, lower concentrations were able to kill the bacteria.

The bactericidal effects of the disifectants, along with the control formalin, on the contaminated carriers are shown in Table (3). The MIC after the shortest (15 min.) and the longest (120 min.) intervals will be mentioned where the bacteria carried on the aluminium and ceramic were killed by concentrations fluctuating between 5% (in 15 min.), except that the Pseudomnas aeruginosa was killed by a 2.5% formalin, and 0.5%-2.5% (in 120 min.). Comparably, lower bactericidal concentrations (1%-2.5%) were needed to decontaminate the wood carriers.

DISCUSSION

It is necessery for the veterinary and the public health diciplins to adopt a strict policy of disinfection taking in consideration the different interfering factors (GELINAS and GOULET, 1983 b, ANON, 1980 b). In developing countries, the low hygienic conditions in veterinary sectors parallel with the limited education of the cleaners complicate the control of the harmfull microorganisms.

The obtained results indicate that very slight differences in the effecacies of the both disinfectants against the used bacteria (Tables 1,2). Indeed, the cidal concentration limits were higher in the germ carrier test (Table 3) than those obtained in the suspension test (Table 2). This may be attributed either to the nature of the carriers as in the first test and due to the direct contact between the reactants as in the second one.

Five species representing both of the bacterial Gram groupings were used in this study. Furthermore, they reflect the different possibilities of contamination and hygienic situations. Two of them, namely the Staphyloccus aureus and the Pseudomonas aeruginosa, among other bacterial and fungal species, were reported, with reference to their resistance pattern, to be suitable for the germicidal testing KIRPAL, 1973.

Both disinfectants showed equal germicidal concentrations on the smooth nonsoaking aluminium and ceramic carriers along the whole interaction intervals, except that the lysol needed to be in higher concentration of 2.5% to kill the Pseudomonas aeuginosa after 120 minutes. On wood, on the other side, they showed lower concentrations (table 3). This is most likely due to the rough surface and to the soaking nature of the wood which facilitate the diffusion and the retention of more amounts of the reactants. These results seem to be slightly deviated from the findings of GELINAS and GOULET, 1983 a. They reported some variations in disinfecting the aluminium, plastic and stainless steel which have, in general, smooth surfaces. However, the utilized carriers in this work represent the materials which are commonly and widely used for constructional purposes in the veterinary and eventually other practices.

The diversions in the sensitivities among strains of the same species or among the different species (NAMBA, et al. 1985; BOSENBERG, 1966) and the predected variations in the results of the in-use and the laboratory testings complicate the choose of the test microorganism (OJAJARVI, 1976). DOTT, et al. 1981 found that the prolonged and constant exposure of some microorganisms like the Pseudomonas to the in-use disinfectants in a centralized disinfection devices had resulted into their development of temporary resistance. Comparing our findings with these discussed points. One can safely conclude that the examined disinfectants can be applied effeciently in the different veterinary aspects in the concentrations displayed in the tables (1,2 & 3) taking in consideration, every now and then, their in-use effectiveness.

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Table (1)

The minimum bacteriostatic concentrations and the reciprocal values of the septol and lysol

Disinfectant #	Se.	Ly.	Ph.
Bact. spp.	%(RIV)*	%(RIV)	%(RIV)
Staph.aur.	0.06(1666)	0.06(1666)	0.06(1666)
E.coli	0.125(800)	0.06(1666)	0.06(1666)
Prot.vulg.	0.125(800)	0.125(800)	0.06(1666)
Pseud.aerug.	0.250(400)	0.125(800)	0.125(800)
B.cereus	(5 ()20)	)5 ()20)	(5 ()20)

* %: Minimum inhibitory concentration.
RIV: Reciprocal inhibition value.

Se: Septol; Ly: Lysol; Ph: Phenol.

Table (2)

The minimum bactericidal concentrations in correlation with the time factor of the septol and lysol

Bact.spp.	Min.	Minimum bactericidal concentrations %		
		# Se.	Ly.	Control Ph.
Staph.aur.	2	1	1	1
	5	1	0.1	1
	15	0.05	0.1	1
	30	0.05	0.1	1
Esch.coli	2	1	1	1
	5	1	0.1	1
	15	1	0.1	1
	30	1	0.1	1
Prot.vulg.	2	1	2	1
	5	0.1	2	1
	15	0.1	1	1
	30	0.1	0.1	1
Pseud.aerug.	2	1	1	1
	5	1	0.1	1
	15	1	0.1	1
	30	1	0.1	1

#: Se.:Septol, Ly.:Lysol, Ph.:Phenol.

Table (3)

Bactericidal effects of the septol and lysol on three germ carriers

Bact.spp.	Min.	Minimum bactericidal concentrations %								
		Aluminium			Ceramic			Wood		
		# Se.	Ly.	Fo.	Se.	Ly.	Fo.	Se.	Ly.	Fo.
Staph.aur.	15	5	5	5	5	5	5	2.5	2.5	1
	30	2.5	2.5	2.5	2.5	2.5	2.5	1	1	1
	60	1	1	1	1	1	1	0.5	0.5	0.5
	120	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Esch.coli	15	5	5	5	5	5	5	2.5	2.5	1
	30	5	2.5	2.5	5	2.5	2.5	2.5	1	1
	60	2.5	1	1	2.5	1	1	1	0.5	0.5
	120	1	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5
Prot.vulg.	15	5	5	5	5	5	5	2.5	2.5	1
	30	5	5	2.5	5	5	2.5	1	1	1
	60	2.5	2.5	1	2.5	2.5	1	1	0.5	0.5
	120	1	2.5	0.5	1	1	0.5	0.5	0.5	0.5
Pseud.aerug.	15	5	5	2.5	5	5	2.5	2.5	2.5	1
	30	5	5	2.5	5	5	2.5	2.5	1	1
	60	2.5	2.5	1	2.5	2.5	1	1	0.5	0.5
	120	1	2.5	0.5	1	1	0.5	0.5	0.5	0.5

Se :Septol; Ly :Lysol; Fo :Formalin.