

Comparative Efficacy and Antimicrobial Activity of Three Different Disinfectants and Standard Disinfectant against Diverse Pathogens.

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Abstract

Objective

To determine the efficacy and antimicrobial activity of three different brands of disinfectant against pathogens.

Methodology

The present study was conducted at department of microbiology, Herbion Pharmaceutical (Pvt.) Limited Karachi, Pakistan. Our standard disinfectant contains , whereas comparative disinfectants Brand A containing cetrimide and chlorhexidine gluconate , Brand B lemon disinfectant containing Didecyl dimethyl ammonium chloride and branched, ethoxylated 4-Nonylphenol and Brand C which contains Alkyl (60%C14, 25%C12, 15%C16) dimethylbenzyl ammonium chloride . The zone of inhibition or Antimicrobial susceptibility pattern of these disinfectants was noted against *Staphylococcus aureus* (ATCC-6538), *Escherichia coli* (ATCC-8739), *Pseudomonas aeruginosa* (ATCC- 9027), *Bacillus subtilis* (ATCC-6633), *Aspergillus niger* (ATCC-16404), *Candida albicans* (ATCC-10231).

Results

The different pattern of millimeter zone of inhibition is detected when compared directly in concentrated form and with the different dilution; 1:10 and 1:100ml of disinfectant against various pathogens.

Conclusion

It was concluded that Chloroxylenol (Standard Disinfectant) is more favorable and frequently used in pharmaceutical industries and considered to be more reliable as compare to other disinfectant. The surface or inanimate object are more secure and germ free after cleaning with standard disinfectant. The second-best choice in cleaning after Chloroxylenol is Brand B lemon disinfectant containing Didecyl dimethyl ammonium chloride and branched, ethoxylated 4-Nonylphenol.

Key Words

Disinfectant, Pathogen, Antimicrobial activity, bacteria, molds,

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yeasts.

Introduction

Disinfectants are the cleaning procedures for elimination of microorganisms from working premises includes hospitals, health care units, and industries, household from non-living objects. Sometimes, due to mutation, some microorganisms including bacteria, virus, mold, yeast and protozoa become resistant to several chemical agents.^{1,2} Disinfectants behave bactericidal and fungicidal to many vegetative states of bacteria but spore remain resistant to chemicals, high temperature, short-time disinfection and small amount should remove wide variety of microorganisms belongs to different species or same species.^{3,4} A good disinfectant should not have any toxic effects or side effects to skin, body, eyes and most sensitive parts of human system.⁶ Chloroxylenol is the most frequently disinfectant used in homes and health care settings for disinfecting objects, surfaces, wall, floor and equipment's. **Surface Disinfection** for hospitals and household grade disinfection, prepare a 1:20 dilution using 20ml of standard disinfectant in 400ml of water. Wipe down hard surfaces around the home; no need to rinse.⁵

Chloroxylenol have always been positioned as a 100% germ fighter with germ fighting and protection as the core value. Savlon introduced as first aid solution for treatment of mild scarring, burns, cuts and bruises as well as skin healing treatments for spots.^{6,7} Brand C equipment disinfectant, deodorizer, virucide and sanitizer especially designed for the food service, food handling and food processing industries. This is the germicidal detergent that disinfects and deodorizes in one, labor-saving step, effectively kills and removes numerous strains of pathogenic bacteria and also use in sanitizing of any hard non-porous surface. Lemon disinfectant is a neutral PH, hospital grade cleaner and deodorizer, germicidal that quickly removes dirt, grime, mildew, body oils and other common soils and effective against broad spectrum of bacteria and viruses.^{8,9}

Methodology

Reagents and Chemicals

TSA, TSB, lactose and peptone water test tubes, ATCC cultures

Apparatus

Glass wares including Petri plates and pipettes

Collection and Isolation of Bacterial Strains

Sterilize all glass wares including Petri plates and pipettes. Prepare media that are required for performing antimicrobial activity testing (TSA, TSB, lactose and peptone water test tubes). Take all stock ATCC cultures and sub culture it in TSB and incubate it for 3 -5 days.

When growth occur streak on Petri plates containing TSA media in order to get isolated colonies, incubate it at 32 + 2.5 C for 1 day. After incubation period, take heavy loop full of cultures and inoculate it into test tube containing peptone.

Procedure for Antimicrobial activity of different Brands A, B and C against on Pathogens.

Water that is dedicated for that particular organism. Next step is to make serial dilution in peptone water test tubes from 1: 10 to 1:100. Then take 1 ml from each tube and transfer it into Petri plate that was specifically mark for that particular organism. Then Pour 15 -20 ml TSA in each plate and incubate for 3 days¹⁰. Keep all the test tubes in refrigerator. After incubation period read plates and count no of Colony forming unit at each dilution factor. Record the entire results make Dettol antiseptic as standard. Take sample of standard, Brand A Brand B Disinfectant, Brand C Equipment cleaner for testing. Next step is to take culture of *Bacillus subtilis*, *S.aureus*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *E.coli*, *Aspergillus niger* and *Candida albicans* from TSB and pour it into melted respective TSA agar i.e. (40 °C – 45 °C). Mix it and transfer it in sterile Petri plates. Cover the plate and leave it to solidify. Incubate all plate for 1-5 days. The test will be performed in duplicate. Next day take out all plates and transfer 0.5ml of different disinfectants respectively on petri plates with the help of micropipettes for each organism. Plates were incubated for 2 – 5 days.¹¹⁻¹³ Measure zone of inhibition with the help off Vernier Caliper. The average zone of inhibition is ± 1mm.

Results and Discussion

The findings of present studies showed that the measured zone of inhibition with use of Chloroxylenol present in standard disinfectant is more effective as compare to other disinfectants almost against on all pathogen except *Pseudomonas aeruginosa* and *Bacillus subtilis*. The zone of inhibition with Brand B lemon surface Disinfectant and Brand C equipment cleaner worked more against *Pseudomonas aeruginosa* and *Bacillus subtilis* (Fig. 1). The higher zone of inhibition is detected in Dettol against *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, *Aspergillus niger* and *Candida albicans*. (Table 1).

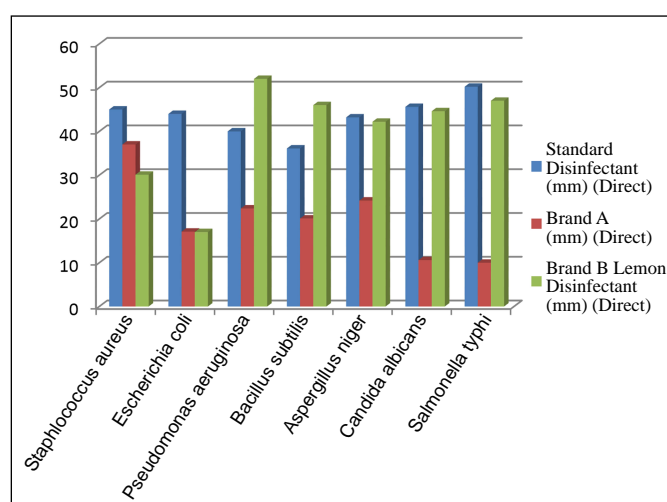


Fig 1. Evaluation of Antimicrobial activity of concentrated standard standard disinfectant with Brand A, Brand B lemon Disinfectant and Brand C Equipment cleaner against different bacterial and fungal pathogens in direct dilution.

Table 1: Evaluation of Antimicrobial activity of concentrated standard disinfectant with Brand A, Brand B lemon Disinfectant and Brand C Equipment cleaner against different bacterial and fungal pathogens in direct dilution.

Organisms	Standard Disinfectant (mm) (Direct)	Brand A (mm) (Direct)	Brand B Lemon Disinfectant (mm) (Direct)	Brand C Equipment cleaner (mm) (Direct)
<i>Staphylococcus aureus</i>	45	37	30.1	30
<i>Escherichia coli</i>	44	17.1	17	25
<i>Pseudomonas aeruginosa</i>	40	22.4	52	54
<i>Bacillus subtilis</i>	36.1	20.1	46	47
<i>Aspergillus niger</i>	43.2	24.2	42.2	39
<i>Candida albicans</i>	45.6	10.6	44.6	47
<i>Salmonella typhi</i>	50.2	10	47	40

We evaluated that the standard disinfectant is more effective in 1:10 dilution as compare to other disinfectants almost against all pathogens except *Pseudomonas aeruginosa* and *Bacillus subtilis*. The greater zone of inhibitions have been seen from Dettol and recommended for cleaning in all industries and hospitals for hygienic purpose (Table 2). The Zone of Inhibition observed with Brand B lemon Disinfectant and Brand C equipment cleaner worked better against on *Pseudomonas aeruginosa* and the Zone of Inhibition found with Brand C equipment cleaner worked better against on *Bacillus subtilis* (Fig. 2). The results shown that the Dettol are more effective in 1:100 dilution as compare to other disinfectants in (Table 3). It is also evaluated that Chloroxylenol present in standard

disinfectant was more effective than other disinfectants almost against on all pathogens except *Pseudomonas aeruginosa* and *Bacillus subtilis*. The greater zone of inhibitions have been seen and recommended for cleaning in all industries and hospitals for hygienic purpose. The zone of inhibitions of Brand B lemon surface Disinfectant and Brand C equipment cleaner worked better against on *Pseudomonas aeruginosa* (Fig. 3). The Antimicrobial activity was checked of Brand A Disinfectant, Brand B lemon disinfectant and Brand C equipment disinfectant. Standard disinfectant has proven for 100% efficiency and killing ability as compare to other disinfectants and protects from 100 illness producing microbial germs. Standard Disinfectant containing Chloroxylenol removes germs from skin; safeguards

Table 2: Evaluation of Antimicrobial activity of concentrated standard disinfectant with Brand A, Brand B lemon Disinfectant and Brand C Equipment against different bacterial and fungal pathogens in 1:10 dilution.

Organisms	Standard Disinfectant (mm) (1:10ml dilution)	Brand A (mm) (1:10ml dilution)	Brand B Lemon Disinfectant (mm) (1:10ml Dilution)	Brand C Equipment cleaner (mm) (1:10ml Dilution)
<i>Staphylococcus aureus</i>	38	20	18.1	19
<i>Escherichia coli</i>	35	10.9	15	14.9
<i>Pseudomonas aeruginosa</i>	39.8	32.7	40.7	45.7
<i>Bacillus subtilis</i>	34	14	33.1	37
<i>Aspergillus niger</i>	36.2	16.2	34.2	34.2
<i>Candida albicans</i>	48.2	2.2	35.1	36.1
<i>Salmonella typhi</i>	40	12	37	30

Table 3: Evaluation of Antimicrobial activity of concentrated standard disinfectant with Brand A, Brand B lemon Disinfectant and Brand C Equipment cleaner against different bacterial and fungal pathogens in 1:100 dilution.

Organisms	Standard Disinfectant (mm) (1:100ml dilution)	Brand A (mm) (1:100ml dilution)	Brand B Lemon Disinfectant (mm) (1:100ml Dilution)	Brand C Equipment cleaner (mm) (1:100ml Dilution)
<i>Staphylococcus aureus</i>	25	11	15	17.1
<i>Escherichia coli</i>	23.2	1.5	10.2	10.2
<i>Pseudomonas aeruginosa</i>	28.5	16.7	38.5	39.5
<i>Bacillus subtilis</i>	16.2	2.2	16.7	19.2
<i>Aspergillus niger</i>	14.1	3.3	13.1	13.1
<i>Candida albicans</i>	21.3	0	12.2	14.1
<i>Salmonella typhi</i>	30	2	22	12.4

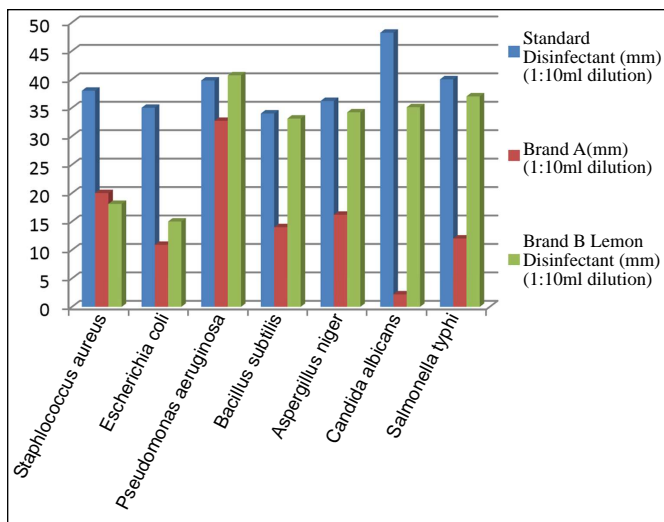


Fig 2. Evaluation of Antimicrobial activity of concentrated standard standard disinfectant with Brand A, Brand B lemon Disinfectant and Brand C Equipment cleaner against different bacterial and fungal pathogens in 1:10 dilution.

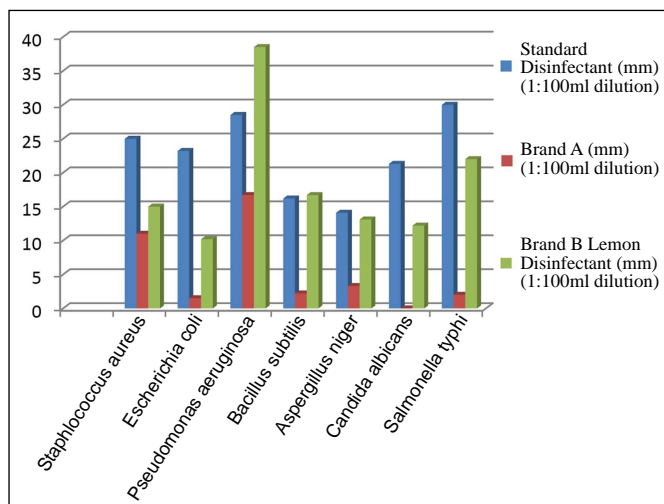


Fig 3. Evaluation of Antimicrobial activity of concentrated standard disinfectant with Brand A, Brand B lemon Disinfectant and Brand C Equipment cleaner against different bacterial and fungal pathogens in 1:100 dilutions.

from infections caused by cuts and scratches and can also be used as household disinfectant on home surfaces and in laundry. The highest zone of inhibition is seen in all forms from standard that is (Direct, 1:10 and 1:100). 1. *Staphylococcus aureus* formed 45mm, 38mm, and 35 mm. 2. *Escherichia coli* formed 44mm, 35mm, and 23.2mm. 3. *Pseudomonas aeruginosa* formed 40mm, 39.8mm, and 28.5mm. 4. *Bacillus subtilis* inhibited by 36.1mm, 34mm, 16.2mm. 5. *Aspergillus niger* inhibited by 43.2mm, 36.2mm, 14mm. 6. *Candida albicans* inhibited by 45.6mm, 48.2mm, 21.3mm. 7. *Salmonella typhi* inhibited by

50.2 mm, 40mm and 30mm respectively.¹⁴

The results shown that the Zone of Inhibitions from standard were more effective as compare to other disinfectants almost against on all pathogens except *Pseudomonas aeruginosa* and *Bacillus subtilis*. The Zone of Inhibitions from Brand B lemon surface Disinfectant shown 52mm and 55mm and equipment cleaner shown 46mm and 47mm eliminate more frequently against *Pseudomonas aeruginosa* and *Bacillus subtilis* respectively.

The greater zone of inhibitions has been seen from standard recommended for cleaning in all industries and hospitals for hygienic purpose. The resulted zone of inhibition from 1:10 dilution Brand B lemon surface Disinfectant and Brand C equipment cleaner worked better against on *Pseudomonas aeruginosa* that is 40.7mm and 45.7mm, the zone of inhibition seen in Brand C equipment cleaner against on *Bacillus subtilis* is 37mm. The zone of inhibitions from standard were more effective as compare to other disinfectants almost against on all pathogens except *Pseudomonas aeruginosa* and *Bacillus subtilis* in 1:100 dilution The zone of inhibitions from Brand B lemon surface Disinfectant and equipment cleaner showed greater zone of inhibition against *Pseudomonas aeruginosa* and *Bacillus subtilis* that is 38.5mm, 39.5mm and 16.7mm, 19.2mm respectively.

Conclusions

It was concluded that standard Disinfectant is more favorable and frequently used in pharmaceutical industries and considered to be more reliable as compare to other disinfectant. The surface of object is more secure and germ free after cleaning with Chloroxylenol. The second-best choice in cleaning after standard containing Chloroxylenol is Brand B lemon disinfectant and then Brand C Equipment Disinfectant.

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