



Short Communication

Efficacy of a combination of antiseptics over a single agent for microbial control in a household setting

Shashank S. Joshi^{1*} and Shital S. Joshi²

¹Computer Science, VIT Pune. 7- Professor VIT Pune, India

²Consultant Pathologist Sahyadri Speciality Labs, Pune, India
shashankjoshi124200@gmail.com

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Abstract

Antiseptics and disinfectants are extensively used in hospitals and Health care settings as well as homes for a variety of hard surface cleaning applications. Each group of antiseptics and disinfectants has their advantages and disadvantages. Efficacy and safety are major concerns in choosing disinfectants. Unlike antibiotics, Disinfectants are rarely tested for their efficacy. We tested a combination of Disinfectants Cetrimide, Formaldehyde and Benzlkonium chloride against single agent cetrimide. We found that “Combicide One” our combination proved much superior to the single agent. A combination of disinfectants is very important to enhance efficacy of these disinfectants towards the controlling microbial population which will lead to prevention of disease transmission and infection.

Keywords: Antiseptic, disinfectant, biocide, cetrimide, formaldehyde, benzalkonium chloride.

Introduction

Antiseptics and disinfectants are frequently used in hospitals as well as homes for a variety of cleaning applications. They mainly fall into the following categories¹. Alcohols (Ethyl alcohol), Aldehydes (formalin), Anilids (Triclocarban), Biguanides (Chlorhexidene), Diamidines (propamidine and dibropropamidine), Chlorine releasing agents (sodium hypochlorite), Iodine and iodophores (betadine), Silver compounds (silver sulfadiazine), Peroxygens (Hydrogen peroxide, Phenols and Bisphenols (triclosan), Halophenols (Chloroxylenol), Quaternary Ammonium compounds- surface active agents, Vapor phase sterilant.

Out of these classes some are reserved for topical application in humans because of their compatibility with human tissues. Some like formaldehyde are known to cause genetic damage and hence their use is limited. Phenolic agents have high toxicity and are not biodegradable.

Many of the market available agents like Chloroxylenol are single agents and have propensity to develop antimicrobial resistant. Hence there is constant need for upgradation to situation specific cleaning agents.

We suggest a combination of antiseptic agents, nicknamed, “Combicide One” to minimize toxicity and maximize efficacy as far as antimicrobial resistance is concerned.

Aim and objectives: To compare the efficacy of a combination of antiseptics over a single agent on the following parameters. Culture of pathogenic organisms’ post cleaning.

In various household settings like Drawing room, Kitchen platform, Toilets.

Materials and methods

Following was the combination Nicknamed, “Combicide One”: Benzalkonium chloride 2% w/v- 80% (800ml/1L), Formalin 10% w/v- 2% (20ml/1L), Cetrimide 3%- Remaining portion 18% (180ml/1L).

It was tested against single agent Cetrimide.

Sample size: 30 samples with the combination agent, “Combicide One” and 30 samples with a single antiseptic agent in both the household and hospital settings.

Cleaning Method: A thorough cleaning of an area of 10 by 10 square feet was done over a period of 10 minutes in each setting i.e. drawing room, kitchen platform and toilet. A new swab was used each time. Cleaning was done by the same person for each setting. 20 minutes after thorough cleaning a swab was obtained one each from part of the floor cleaned. It was subjected to microscopy and culture.

Findings of culture were tabulated and the results were interpreted as per each table.

Results and discussion

We used Fisher exact test to calculate significance.

Following are the findings on number of cultures (more than 10^5 CFU) of micro-organisms from kitchen samples (n=30 samples each) (Table-1)

Following are the findings on number of cultures (more than 10^5 CFU) of micro-organisms from toilet samples (n=30 samples each) (Table-2)

Following are the findings on number of cultures (more than 10^5 CFU) of micro-organisms from drawing room samples (n=30 samples each) (Table-3).

Discussion: The results obtained in this study are tabulated in three tables. They show, that ‘Combicide One’ is – i. More effective than single agent in kitchen settings ($p < 0.05$) (highly significant), ii. More effective than single agent in toilet settings ($p < 0.02$), iii. And more effective than single agent in drawing room settings ($p < 0.02$).

Sinister Gram-Negative organisms like Pseudomonas and E. Coli were effectively controlled by ‘Combicide One’. i. Escherichia coli is a bacteria having fecal origin and is a contaminant which causes many diseases. Staphylococcus aureus is also known to cause wound infection and is a commensal of skin, and Streptococcus sp. is blamed to cause sore throat². Sallmonela typhi is a cause of typhoid fever. ii. These disinfectants are to reduce cases of acquired diseases caused by the microorganisms tested. An ideal disinfectant should have a broad antimicrobial spectrum (meaning should cover a variety of micro-organisms), should not be irritating, less toxic, noncorrosive and cheap. iii. Although phenols have high toxicity and low biodegradability, they are still in use in

developing countries because of their low cost. They are considered risky to health by the Environmental Protect Agency (EPA), and cannot be used in neonatal, pediatric ICU or on any place where they can come in contact of infants. Irritation of eyes, contact dermatitis and depigmentation of the skin have been blamed to phenol residue contact.

When we compare antibiotics with biocides like the one under study in the present paper the following are the established facts. In general, biocides are broader in spectrum of activity than antibiotics. While antibiotics have specific intracellular targets, biocides have multiple targets. Antimicrobial activity can be influenced by many factors such as formulation effects, presence of an interfering organic material, synergy, temperature, dilution, and test method. The widespread use of antiseptic and disinfectant products has led to the development of microbial resistance and cross-resistance to antibiotics (meaning resistance to one class of antibiotic automatically leads to resistance to similar another antibiotic). Resistance can be either a natural property of an organism (intrinsic) or acquired by mutation or acquisition of plasmids (transmissible genetic material of bacteria)². Plasmids are small double stranded DNA molecules distinct from the genetic apparatus of the bacteria which confer the property of antibiotic and biocide resistance on the bacteria. Intrinsic resistance is demonstrated by gram-negative bacteria like E. coli, bacterial spores, mycobacteria, and, under certain conditions, staphylococci which are gram positive. Acquired, plasmid-mediated resistance is most widely associated with compounds containing mercury and other metallic salts. Recently, acquired resistance to certain other types of biocides has been observed, notably in staphylococci.

Table-1: Culture reports from kitchen samples.

Agent	Pseudomonas	Proteus	E. coli	Streptococci/ Staphylococci	No Growth	Total	P value
Cetrimide	0	0	6	6	18	30	0.005
Combicide One	0	0	0	2	28	30	

Table-2: Culture reports from Toilet Samples.

Agent	Pseudomonas	Proteus	E. coli	Streptococci/ Staphylococci	No Growth	Total	P value
Cetrimide	6	4	0	0	20	30	0.02
Combicide One	2	0	0	0	28	30	

Table-3: Culture reports from Drawing room samples.

Agent	Pseudomonas	Proteus	E. coli	Streptococci/ Staphylococci	No Growth	Total	P value
Cetrimide	0	0	0	4	26	30	0.02
Combicide One	0	0	0	0	30	30	

When we searched the literature, we found that the efficacy of antibiotics or their combination are extensively studied owing to their administration inside human body and utility in treating diseases. But even though Biocides like 'Combicide One' are useful in preventing diseases they very minimally studied owing to under-regulation in the commercial market. It is very useful to study the efficacy of biocides because we can scientifically establish the bacteria- fungi kill ability of the agent and market it comfortably. If we can scientifically tell the general population the facts, the sales will get a boost and pricing power will increase.

Recently, the FDA has divided biocides into healthcare antiseptics, food industry antiseptics and consumer usable antiseptics. It has also been decided that all antiseptic products that include antimicrobial labeling, i.e. kills the germs that cause body odor, are drugs and are required to demonstrate their action. Thus, such studies become all the more relevant.

We recommend 'Combicide One' in the household and commercial settings, of course being a biocide, it is not suitable for human body. Researchers suggest that biocides be monitored in the future, so that if a strong resistance occurs, decisions can immediately be made on whether this substance is more of a risk rather than a benefit. Raut et al³ found that out of market available combinations of Dettol, Savlon, Lifebuoy, Hydrogen peroxide the former two were very active than later two as far as Staphylococci, E. Coli, Salmonella and Streptococci are concerned. We ourselves did not want to compare such brands as it was not our objective.

In a study by Abdu M. Alkolaibe et al⁴, E. coli and Proteus sp. were found to be the most susceptible bacteria when tested against Dettol (Chloroxylenol), Salvon (Chlorhexidine, cetrimide) and formalin disinfectants and antiseptics while are more resistant to Chlorox and Spirit. The same study also states that Staph. Aureus (a gram-positive organism) was more sensitive to Salvon and Chlorox while more resistant to Dettol, formalin, Spirit, Iodine and Ethanol in all hospitals. Also, Pseudomonas aeruginosa, was resistant bacteria to Chlorox, formalin, Spirit, Iodine and Ethanol while it is sensitive to Salvon and Dettol disinfectants agents in all hospitals.

Thus, it is clear that microorganisms do adapt to a variety of physical, environmental and chemical conditions, and therefore

resistance to extensively used antiseptics and disinfectants has been reported. It was our modest attempt in this direction to overcome the resistance to dangerous micro-organisms.

Conclusion

A combination of disinfectants enhances efficacy of these disinfectants towards the controlling microbial colonies which facilitates prevention of disease transmission and infection.

It also indirectly helps prevent spoiling of materials which could also lead to microbial infection.

Antimicrobial effectiveness of disinfectants should be determined frequently to achieve total disinfection of important hard surfaces in our household like kitchen, toilets etc.

"Combicide One" is definitely more effective than Cetrimide in controlling micro-organisms in Various Household Settings.

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