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Research Article

Effectiveness of Instrument Pre-Cleaning and Disinfection Sprays Against the Microbial Burden and Blood Stains Remover on Medical Devices

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Abstract

Central Sterile Services Department (CSSD) has an essential role in receiving medical devices with the transmission of medical-related pathogens. During the last few years, several innovative instruments, pre-cleaning, and disinfecting products have been brought to market in Thailand. In this study, commercially available product effects of instruments for pre-cleaning removal of blood stains were compared using 2 different application methods. Disinfection testing has been sent to a standardized laboratory in Thailand. The aim of this study was to determine the effectiveness of pre-cleaning and disinfection sprays against the microbial burden and blood stains remover on medical devices containing extracts from Thai agricultural products simultaneously cleaning, disinfecting, and removing blood stains on medical devices. The multi-center Central Sterile Supply Department was an evaluation of two methods for assessing prepares the medical instruments after the surgery operation. Pre-cleaning-disinfecting sprays based on mangosteen extract, *Garcinia mangostana* (L.), *Syzygium aromaticum* (L.) Merrill. & Perry extracts with Ethoxylated Alcohol active ingredients were tested for their efficacy in removing the microbial burden and blood stains. The contact time for the removed blood stains was tested by a simple visual and blood stains test strip at different times: 1, 2,3, 4, and 5 minutes. Pre-cleaning-disinfecting spray products for all bacteria and viruses reduced the microbial count with a log10 reduction >5 with a 10-minute exposure time. All fungi reduced the microbial count with a log10 reduction >5 with a 10-minute exposure time except for a spray based on natural extracts and Ethoxylated Alcohol. A significant difference in 2 minutes ($P \leq .005$) was observed using cleaning indicators measurements. The findings of this study show that a ready-to-use pre-cleaning-disinfecting spray is extremely important in reducing the possible transmission of all microorganisms and removing blood stains on Medical Devices

Keywords: Blood stains; Disinfection sprays; Instrument pre-cleaning; Medical devices

Introduction

The Central Sterile Supply Department (CSSD) is an important supportive service at the hospital, ensuring an infection-free environment [1,2]. The CSSD is an integrated area in hospitals and other healthcare facilities that sterilizes and performs other actions on medical devices, equipment, and consumables for subsequent use by healthcare providers in the hospital operating theatre and for other aseptic procedures, such as Performing surgeries [3]. To more easily control quality, the central sterile supply department worker should perform the majority of the cleaning, disinfecting, and sterilizing of patient-care supplies in a central processing department. The goal of central processing is to process medical and surgical instruments in an orderly manner to protect patients from infection while minimizing risks to staff and preserving the value of the items being reprocessed [4] In performing various procedures after using medical types of equipment from the operating room department, obstetrics department, and other departments. There were blood stains on the instrument before it was sent to the CSSD department for cleaning. Many stains are commonly found on medical devices and common in hospitals, especially among patients, the elderly, mischievous young children, or menstruating women. Several studies in various countries have revealed a lack of adherence to established pre-cleaning and disinfection sprays against the microbial burden and blood stains on medical devices. Although there are currently many products for the convenience of pre-cleaning in many sprays, they are often expensive, and the main components are only chemicals that destroy water resources and are frequently irritating to the skin. Furthermore, some chemicals are harmful to the body, either through acute allergies or the accumulation of toxicity in the body [5]. There have been few studies on the use of extracts from Mangosteen (*Garcinia mangostana* L.), and *Syzygium aromaticum* (L.) Merrill. & Perry to remove blood stains [1]. This study aimed to determine the effectiveness of simultaneously cleaning, disinfecting, and removing blood stains on medical devices.

Methods

The study was conducted at the multi-center Central Sterile Supply Department and was an evaluation of two methods for assessing prepares the medical instruments after the surgery operation. This study was conducted in the CSSDs of five public hospitals in Thailand from August - October 2022. MEDI PLUS pre-cleaning and disinfection sprays against the microbial burden and blood stains remover on medical devices containing extracts from Thai agricultural products, including Mangosteen (*Garcinia mangostana* L.), and *Syzygium aromaticum* (L.) Merrill.& Perry with Ethoxylated Alcohol active ingredients was tested in this study was obtained by applying the protocol of two studies of the dissolution time of blood stains: The methods were a test by a simple visual and blood stains test strip (Figures 1,2). The contact time for the removed blood stains by simple visual observation test and blood stains test strips at different times: 1, 2, 3, 4, and 5 minutes. In a multicenter Central Sterile Supply Department trial, 100 identical surgical devices were prepared, divided into 50 visual tests and 50 test strips, for each hospital. The study of bloodstain dissolution was performed by a simple visual in the bloodstain dissolution test by timing. The second method of bloodstain dissolution study was performed by inserting a test strip into a kidney-shaped bowl and testing the bloodstain dissolution by timing. The study on the bactericidal and antiviral properties of the product was tested by sending samples to the medical laboratories of the Faculty of Medical Technology in Thailand. One-step cleaner disinfectant following AOAC Official Methods 955.14, 955.15, 964.02, and 955.17 according to standard AOAC methods analysis (2010). Microbial burden efficiency test results, *Staphylococcus aureus* (ATCC 6538), *Salmonella choleraesuis* (ATCC 10708) *Pseudomonas aeruginosa* (ATCC 15442), and the dilution of samples were tested. The test of bacterial growth after exposure to 60 contaminated carriers to disinfectant at 10 min. The test of T. mentagrophytes (*Trichophyton mentagrophytes*) is a clinical isolate. The strain sporulates freely on culture media and produces abundant conidia as required by AOAC Official Method 955.17, AOAC International, 2000. The test microbial burden after exposure to 60 contaminated carriers to disinfectant at 10 min and the dilution of samples were tested. The fungicidal testing by the Drug Delivery System Excellence Center of the Faculty of Pharmaceutical Sciences in Thailand. The fungicidal testing of *C.albicans* (ATCC 90028), and *C. neoformans* by Minimal Inhibition Concentration (MIC) were diluted with culture media at concentrations of 90, 80, 70, 60, 50, 40, 30, 20, and 10% and then test the antifungal activity at the same concentration.

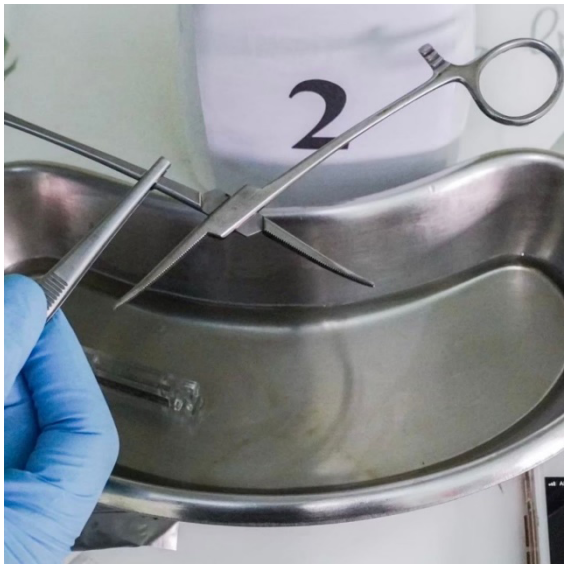

Figure 1: Prepare a sample for a simple visual observation test.

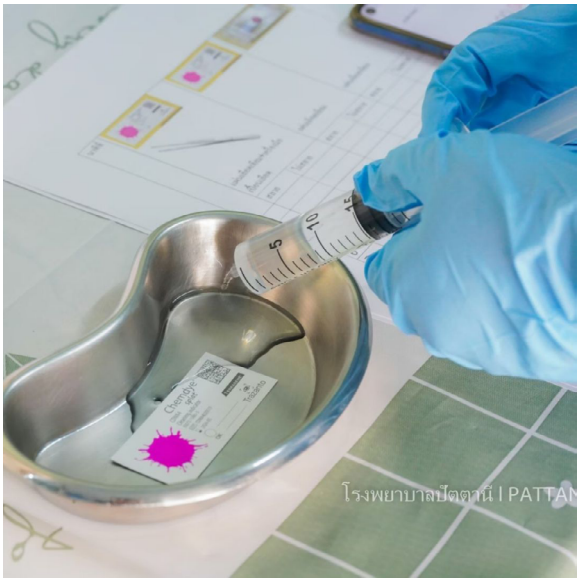

Figure 2: Prepare a sample for a test strip observation test.

Result

The multi-center Central Sterile Supply Department found that the contact time for the removed blood stains by simple visual observation test in 1 minute. The decomposition effect of the blood using test strips begins to react at 1 minute and the hemolysis improves at 2 minutes and beyond (Figures 3,4). A significant difference in 2 minutes ($P \leq .005$) was observed using cleaning indicators measurements. For all bacteria and viruses, ready-to-use pre-cleaning-disinfecting spray products reduced the microbial count with a log10 reduction >5 with a 10-minute exposure time. The study on the bactericidal and antiviral properties of the product results, *Staphylococcus aureus* (ATCC 6538), *Salmonella choleraesuis* (ATCC 10708) *Pseudomonas aeruginosa* (ATCC 15442), and dilution of samples was 1:15. The test of bacterial growth after exposure to 60 contaminated carriers to disinfectant at 10 min. The test of T. mentagrophytes (*Trichophyton mentagrophytes*) is a clinical isolate. The strain sporulates freely on culture media and produces abundant conidia as required by AOAC Official Method 955.17, AOAC International, 2000. The information in Table 1 represents the test of microbial burden after exposure to 60 contaminated carriers to disinfectant at 10 min and the dilution of samples was 1:10. Table 2 showed the fungicidal testing of *C.albicans* ATCC 90028, and *C. neoformans* by minimal inhibition concentration (MIC) of 10%. MEDI PLUS ready-to-use pre-cleaning-disinfecting spray products for all bacteria and viruses reduced the microbial count with a log10 reduction >5 with a 10-minute exposure time. All fungi reduced the microbial count with a log10 reduction >5 with a 10-minute exposure time except for a spray based on natural extracts and Ethoxylated Alcohol. The findings of this study show that a ready-to-use pre-cleaning-disinfecting spray is extremely important in reducing the possible transmission of all microorganisms.

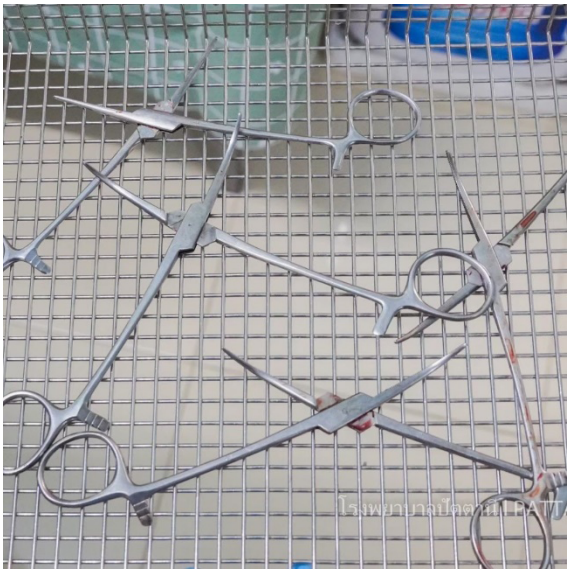

Figure 3: The result of a simple visual observation test in 1 minute.

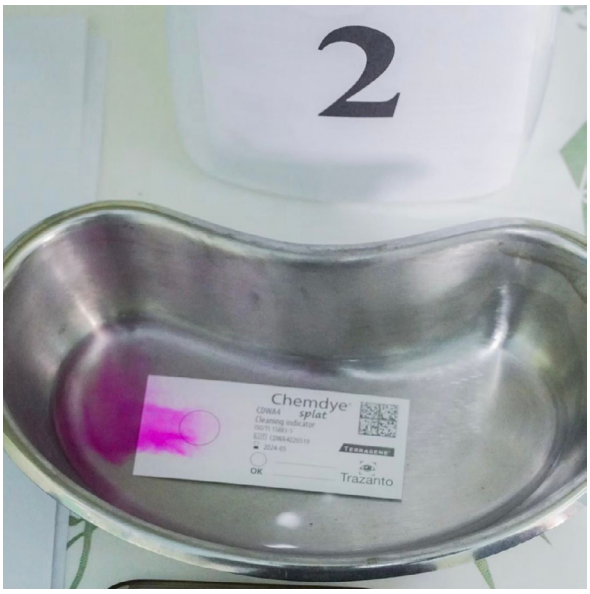

Figure 4: The result of a test strip observation test in 2 minutes.

Test organisms	Bacterial growth after exposure of 60 contaminated carriers to disinfectant at	
	Dilution	10 min
Staphylococcus aureus (ATCC 6538)	1: 15	0/60
Salmonella choleraesuis (ATCC 10708)		0/60
Pseudomonas aeruginosa (ATCC 15442)		0/60
**Trichophyton mentagrophytes*	1: 10	0/60

**T. mentagrophytes* is a clinical isolate. The strain sporulates freely on culture media and produces abundant conidia as required by AOAC Official Method 955.17, AOAC International 2000.

Table 1: The efficiency test results of microorganisms.

Pathogens	Minimal inhibition concentration (MIC)	Minimum bactericidal concentration (MBC)
C. albicans ATCC 90028	10%	10%
C. neoformans	10%	10%

Table 2: The efficiency test results of fungicidal.

Discussion

The effective pre-cleaning and disinfection sprays containing extracts from Thai agricultural products with Ethoxylated Alcohol active ingredients were high efficiencies in simultaneously cleaning, disinfecting, and removing blood stains remover on medical devices. The results of a simple visual and blood stains test strip show effective blood stain dissolution efficiency from 2 minutes onwards. This is in line with the study of Withaya which found that the pre-cleaning spray on blood stain remover was better than the pre-cleaning foam [1,5,6]. Thai Mangosteen extracted with Ethoxylated Alcohol active ingredients can inhibit the growth of *Staphylococcus aureus* (ATCC 6538), *Salmonella choleraesuis* (ATCC 10708) *Pseudomonas aeruginosa* (ATCC 15442). Most of the mangosteen extracted contains the main compound, Xanthones (more than 40 %), which is the core structure of Mangostin. Xanthones are reported to inhibit mold [7-10]. According to a study by Yenjit et al, Xanthones have been reported to inhibit fungi. Many species such as *Rhizopus sp, Alternaria solani, Aspergillus niger, Aspergillus flavus, Penicillium sp, Fusarium roseum,* etc. Mangosteen extract found that many bioactive compounds such as flavonoids, xanthones, and mangiferin, among others, are classified as substances that increase plant resistance and inhibit the growth of microorganisms [9,11,12]. It has also been studied which is consistent with the Sabahat study decoction and essential oil of clove (*Syzygium aromaticum* (L.) Merrill.& Perry) as natural antibacterial agents against 100 isolates belonging to 10 different species of *Gram–ve bacilli viz*, *Escherichia coli*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Enterobacter aerogenes*, *Klebsiella ozaena*, *Klebsiella pneumonia*, *Serratia marcescens*, *Salmonella typhi*, *Shigella dysentriae* and *Vibrio cholerae* [7,12-16]. In a study carried out extracts from Thai agricultural products with Ethoxylated Alcohol active ingredients extract showed an inhibitory effect against microbial burden and blood stains remover on medical devices [17-20].

Conclusions

The findings of this study show that the effectiveness of pre-cleaning and disinfection sprays against the microbial burden and blood stains remover on medical devices containing extracts from Thai agricultural products simultaneously cleaning, disinfecting, and removing blood stains on medical devices extremely important in reducing the possible transmission of all microorganisms. The cleaning-disinfecting sprays, with ingredients from natural extracts, can remove blood stains. Instrument pre-cleaning and disinfection sprays of natural extract and Ethoxylated Alcohol showed comparable effectiveness.

Limitations of the Study

This study had some limitations due to recovery factors that may lead to a remover of blood strains in medical devices of CSSDs, such as contact time, the technique of measurement, and procedure activities. The multi-center Central Sterile Supply Department was recruited from 5 hospitals which is still a small sample. In addition, such studies have not been studied at the

European Standard.

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