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water, Medilox<sup>®</sup>**

Tae Youn Choi, M.D., Won Bae Kim, M.D.

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**Department of Clinical Pathology, College of medicine,  
Soonchunhyang University**

657, Hannam-dong, Yongsan-gu, Seoul, Korea  
TEL : 82-2-709-9425 FAX : 82-2-709-9934

## Bactericidal effect of Disinfectant a Super-oxidized water, Medilox<sup>®</sup>

Tae Youn Choi, M.D., Won Bae Kim, M.D.

*Department of Clinical Pathology, College of Medicine,  
Soonchunhyang University, Seoul, Korea*

**Background** : Disinfection is essential for the prevention of hospital infection. Medilox (Soo San ENC Co., Yongin, Korea), a Super-oxidized water was recently developed as a disinfectant. This is not costly and does not cause any clinical problems and environmental pollution. We evaluated the disinfective activity of Medilox against several clinical isolates of bacteria and yeasts.

**Methods** : 25 strains of bacteria and two strains of fungi were exposed to Medilox (30 & 50 ppm HOCl) disinfectant for the various periods (0.5, 1, 2, 4, 8, 10, 15 and 20 minutes). After the exposure to Medilox disinfectant, 0.01 mL of mixture of microorganisms and Medilox was inoculated into brain-heart infusion broth or onto Sabouraud dextrose agar and incubated at 35°C for 48 hours.

**Results** : All strains of bacteria and fungi were killed within 30 seconds after an exposure to 30 ppm of Medilox. All of three strains of spore forming *Bacillus subtilis* were killed within 4 minutes after an exposure to 30 ppm of Medilox, but all of three strains were killed within 30 seconds in 50 ppm of Medilox.

**Conclusions** : This study showed that Medilox disinfectant was effective for the disinfection of commonly isolated bacteria and yeast from hospital, but less effective against spore-forming bacteria. It may be recommended that Medilox should be used for the effective disinfection of skin, instruments and hospital floors.

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**Key Words** : Disinfectant, Medilox, Hospital infection, Super-oxidized water

## Introduction

Today, nosocomial infections by human and environmental microorganisms are a very important problem in hospitals. Disinfection is essential for the prevention of hospital infection. There are many physical or chemical methods of sterilization, but the most common sterilizer is chlorine compound. Medilox (Soo San ENC Co., Yongin, Korea), one of the Super-oxidized water was recently developed as a disinfectant. This is not costly and does not cause any clinical problems and environmental pollution.

This study has examined the disinfective activity of Medilox against several clinical isolates of bacteria and fungi.

## Materials and methods

### 1. Super-oxidized water (Medilox solution)

Medilox solution was prepared by electrolysis of sodium chloride solution using the Medilox system (Soo San ENC Co., Yongin, Korea). Electrolysis yields Super-oxidized water with pH of 5.0-6.5 and an oxidation-reduction potential of >950 mV containing about 30-50 ppm of hypochlorous acid (HOCl). Freshly prepared Medilox solutions with 30 ppm and 50 ppm of HOCl concentration were used as disinfectants.

### 2. Microorganisms

Test strains were methicillin-sensitive *Staphylococcus aureus*, methicillin-resistant *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Enterococcus faecalis*, *Streptococcus pneumoniae*, *Salmonella typhi*, *Salmonella paratyphi A*, *Salmonella enteritidis*, *Shigella flexneri*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *E. coli*, *Serratia marcescens*, *Klebsiella pneumoniae*, *Enterobacter cloacae*, *Citrobacter freundii*, *Stenotrophomonas maltophilia*, *Proteus mirabilis*, *Chryseobacterium meningosepticum*, *Candida albicans* and spore-forming *Bacillus subtilis* isolated from patients admitted in Soonchunhyang University Hospital in Korea.

### 3. Determination of bactericidal activity

Test bacteria and fungi were cultured into brain-heart infusion broth for 24 or 48 hours at 35°C. Each cultured microorganism was washed three times with phosphate buffered solution (pH 7.2) by centrifugation to remove contaminating organic material derived from the culture medium and the final suspension in PBS used for inactivation studies. Disinfection testing was carried out by adding 0.1 mL of each microorganism suspension to 5 mL of freshly prepared Medilox with 30 ppm and 50 ppm of HOCl concentration and mixing thoroughly ( $10^6$ – $10^7$  CFU/mL). Each organism was exposed to disinfectant for various periods (0.5, 1, 2, 4, 8, 10, 15 and 20 minutes). After the exposure of Medilox disinfectant, 0.01 mL of the mixture of microorganism and Medilox was inoculated into brain-heart infusion broth or onto Sabouraud dextrose agar. The growth of microorganism was examined after incubation at 35°C for 48 hours. All tests were run in duplicate.

## Results

### 1. Bactericidal effect against gram-positive bacteria

Gram-positive bacteria such as methicillin-susceptible *Staphylococcus aureus*, methicillin-resistant *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Enterococcus faecalis* and *Streptococcus pneumoniae* were killed within 30 seconds after the exposure to 30 ppm and 50 ppm of Medilox.

### 2. Bactericidal effect against gram-negative bacteria

Gram-negative bacteria such as *Salmonella typhi*, *Salmonella paratyphi A*, *Salmonella enteritidis*, *Shigella flexneri*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *E. coli*, *Serratia marcescens*, *Klebsiella pneumoniae*, *Enterobacter cloacae*, *Citrobacter freundii*, *Stenotrophomonas maltophilia*, *Proteus mirabilis* and *Chryseobacterium meningosepticum* were killed within 30 seconds after the exposure to 30 ppm and 50 ppm of Medilox.



## Discussion

The most effective method of preventing nosocomial infection includes proper disinfection of hospital surroundings, assured sterilization of various medical instruments, maintenance of clean hands of doctors and nurses that are in contact with patients, thorough disinfection of the area of surgery or treatment and others. Many sterilization methods are being introduced in order to prevent nosocomial infections. Disinfectants play an important role in the prevention of nosocomial infection.

Super-oxidized water prepared by the electrolysis of sodium chloride solution was developed as a disinfectant. It is an electrochemical solution containing a mixture of radicals with strong oxidizing properties. Strongly acidic super oxidized water, developed as Super-oxidized water at the outset, has a problem of low preservative capacity and low sterilizing effect in the presence of organic substances. Medilox, an weakly acidic Super-oxidized water recently developed by Soo San ENC Company in Korea was improved such inadequacies and enhanced the sterilizing effect. It is not costly and does not cause any clinical problems and environmental pollution.

The experimental result of the disinfective activity of Medilox solution showed that general bacteria and fungi isolated in hospital had all been sterilized within 30 seconds to the HOCl concentration of 30 ppm. All of three strains of spore-forming *Bacillus subtilis* were killed within 4 minutes to Medilox with HOCl concentration of 30 ppm, but all of three strains were killed within 30 seconds to the HOCl concentration of 50 ppm. Thus, HOCl concentration should be increased to enhance sterilization for spore-forming bacteria.

The potent biocidal activity of Medilox in the absence of organic matter, after a 30 seconds exposure time, was demonstrated across a range of microorganisms including general bacteria, fungi and spore-forming bacteria. Medilox, as a strong disinfectant, is useful for hand washing, sterilizing of skin and cleaning of the hospital environment. In clinical areas where it is recommended that instruments be thoroughly to remove blood and body fluids before disinfection, Medilox acts as a highly effective disinfecting agent.

It may be recommended that Medilox should be used for the effective disinfection of skin, various medical instruments and hospital surroundings.