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Destruction of *Clostridium difficile* spores colitis using acidic electrolyzed water



To the Editor:

Acidic electrolyzed water (AEW) is a product of an inexpensive electrolysis process. It can be easily synthesized using a simple and relatively inexpensive technology. The use of AEW as a disinfectant has been previously described in the literature, most often in the context of food disinfection, including fruit, vegetables, and eggs. It reduces the morbidity rate caused by bacteria that can be transmitted through these food products, such as *Salmonella* spp, *Listeria monocytogenes*, *Yersinia* spp, and *Escherichia coli*.^{1,2} In addition to disinfection of food products, it has also been reported that AEW can disinfect medical equipment, such as endoscopes and hemodialysis systems.³

The antimicrobial mechanism of AEW is still not fully understood. Some researchers believe that the antimicrobial activity can be attributed to the high oxidation reduction potential (ORP) of AEW. High ORP causes a change in bacterial metabolism and adenosine triphosphate production, probably because of changes in the electron current flow into bacterial cells. Low pH also destabilizes the bacterial outer membrane, resulting in entry of hypochlorous acid into bacteria. Hypochlorous acid, which is very active and contains chlorine compounds, kills bacteria by inhibiting glucose oxidation by certain enzymes that are important in carbohydrate metabolism.^{2,4}

The bacterium *Clostridium difficile* has become a major epidemiologic challenge in recent years. One of the most difficult problems concerning this bacterium is that we do not have an efficient disinfectant for eradication of the bacterial spores found in patients' feces that constitute a source of transferring the infection to other

patients.⁵ In this study we examined the disinfection efficiency of AEW pH 5 against spores of *C difficile*. Bacteria were isolated from patients diagnosed as suffering from *C difficile* infection. Thirty suspensions of *C difficile* spores were prepared at a concentration of 10⁶ spores per milliliter; these spores were grown in AEW prepared with the aid of the Super Oxide Water Ionizer Batch System (BionTech, Gyeonggi-do, Korea). We also compared the disinfection efficiency of AEW and Septadine (chlorhexidine gluconate 0.5 wt/vol and alcohol 70%), which is the customary disinfectant for hands and surfaces.

The survival of spores was monitored every 15 minutes for an hour, using semi-quantitative culture containing CHROMagar *C. difficile* (bioMérieux, Durham, NC) under anaerobic conditions. Under exposure to AEW, there was a gradual decline after 30 minutes in the quantity of surviving spores, and at the end of the trial there were 10³ spores per milliliter. Exposure to Septadine led to a sharp drop in the percentage of living spores after 15 minutes, and within 60 minutes there was complete destruction of all spores. From these results we can conclude that the potential of AEW to destruct *C difficile* spores exists, but the water quality has to be improved, by means of lowering the pH or changing the ORP concentration. AEW's advantage is that it does not cause damage to the environment or to expensive medical infrastructure. In addition, when in contact with water or with any other organic solution, it is neutralized and loses its activity.

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