SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The objective of this study was to examine if copper can inactivate bacteria (that are associated with HAIs) in aqueous solutions.

Antimicrobial activity of copper against organisms in aqueous solution: A case for copper-based water pipelines in hospitals?

Cervantes, H. I., Álvarez, J. A., Muñoz, J. M., Arreguín, V., Mosqueda, J. L., & Macías, A. E. 2013 | *American Journal of Infection Control*. Volume 41, Issue 12, Pages e115-e118

Key Concepts/Context

Poor quality of water is significantly associated, according to the authors, with healthcare-associated infections (HAIs), and this is particularly problematic in developing countries. Literature indicates that patients in developing countries often become infected with waterborne diseases during hospital stays, and ensuing fatalities are not uncommon. Alluding to the potential of contamination of water pipelines because of improper disinfectant distribution and the expense of the different interventions to control waterborne infections, the authors explore the potential of using copper in pipelines. Copper is toxic for a host of bacterial organisms. This paper reports on experiments conducted to test whether copper can incapacitate harmful bacterial organisms in water. The experiments carried out in a controlled environment compared microbial activity in a saline solution and in sterile water contained in bowls of three different materials: glass, polyvinyl chloride (PVC), and copper. The experiment demonstrated that the pathogens were rendered non-viable in both solutions in the copper container, but not in the glass or PVC containers.

Methods

This was an experimental study carried out to test whether pathogenic organisms placed in water in a copper cup can get inactivated. Two sets of experiments were carried out. For the first experiment a high inoculum was prepared, one for 17 different organisms associated with HAI, in a saline solution. This was then put into containers made of copper, PVC, and glass (control). For the second experiment a low inoculum was prepared, one for the same 17 organisms, in sterile water. This was further diluted and then put into the containers as in the first experiment. The

bacterial concentration in each container was measured when the experiment was started. Throughout the experiment period the containers were kept at room temperature (20°C-25°C). Microbial counts were measured at 0 and 30 minutes, 1, 2, 24, and 48 hours. Each experiment was conducted twice. Analysis of Variance or ANOVA was conducted to analyze the results from the experiment.

Findings

The study yielded the following findings:

- In the case of the high inoculum in saline solution:
- In the glass container the count of a few of the organisms decreased close to the 48-hour mark, but for the rest, the count remained the same
- In the PVC container most of the organisms had steady counts except for a few whose counts decreased towards the end of the experiment.
- In the copper container, the counts of most organisms began to decrease after the 30-minute mark. The counts for other organisms began reducing after the 60-minute and 120-minute mark. By the end of 48 hours, all organisms except one had become non-viable.

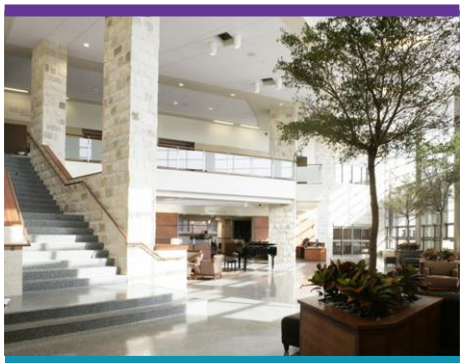
In case of the low inoculum in the sterile water:

- In the glass container the count of a few of the organisms decreased, but for the rest the count remained the same
- In the PVC container the counts of some of the organisms remained steady, but for most counts increased.
- In the copper container, the counts of most organisms began to decrease after the 30-minute mark. By the end of 48 hours, all organisms had become non-viable.

The differences in the behavior of the bacterial organisms in both series of experiments were statistically significant: high inoculum: $P<0.001$; low inoculum: $P<0.001$.

Limitations

Although the authors do not identify any limitations to their study, they provide a caveat that the experiment was conducted in a controlled environment where the micro-organisms were in undisturbed contact with the test materials. This would not be the case in the real world, where other environmental variables would affect microbial activity – like pressure, flow speed, turbulence, etc. Other limitations not cited by the author might include generalizability, as the study seems to be directed to conditions in developing countries where water quality may not be optimal.



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Design Implications

The authors indicate that further studies are required for gathering more conclusive evidence of the effects of copper water pipelines in preventing infections. However, the findings suggest copper pipes might be a consideration for certain healthcare facilities (e.g., in developing countries where water chlorination is a problem).

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