

# Using copper to fight microorganisms

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This article reviews the biocidal mechanisms of copper and its current uses in the fight against transmission of health-associated (nosocomial) pathogens, foodborne diseases, dust mites loads and fungal and wound infections.

Copper has been used as a biocide by many civilizations, such as the ancient Greeks, Celts, Phoenicians, Egyptians, Hindus, Africans, and Aztecs, for treating sores and skin diseases, and for purifying water.

Copper toxicity to microorganisms is achieved through several parallel mechanisms, including:

- Plasma membrane permeabilization
- Membrane lipid peroxidation
- Alteration of proteins
- Inhibition of proteins biological assembly and activity
- Denaturation of nucleic acids

Copper and copper-based compounds are now routinely used in:

- Control of Legionella and other bacteria water distribution systems
- Prevention of algae and other parasites growth in potable water reservoirs
- Reduction of foodborne diseases through self-sterilizing metallic
- Use of materials containing copper in food storage, handling, and transportation
- Reduction of nosocomial infections in hospital settings

The redox cycling between  $\text{Cu}^{2+}$  and  $\text{Cu}^{1+}$ , catalyzes the production of highly reactive hydroxyl radicals, thereby damaging lipids, proteins, DNA and other biomolecules, makes copper highly reactive and a particularly effective antimicrobial.

“... safety of copper to humans and its potent biocidal properties allow the use of copper in many applications, including several that address medical concerns of the greatest importance. ...novel possible applications of copper may have a major effect on our lives.”

Borkow, G. (2012) Using copper to fight microorganisms. Current Chemical Biology 6(2): 93-103.

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