Copper Touch Surfaces: Antimicrobial Properties & Benefits

The transmission, spread and treatment of infectious disease is a HUGE socio-economic issue.

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Project Manager
Wilton Moran
Project Engineer

Healthcare-Associated Infections in the U.S. alone account for:

DEATHS per year

100,000

Healthcare-Associated Infections in the U.S. alone account for:

In HEALTHCARE COSTS per year

$35,000,000,000 to $45,000,000,000

March 2009 report by Centers for Disease Control and Prevention

“Infections acquired during hospital stays (in the U.S.) kill more people than breast cancer, auto accidents and AIDS combined.”

Journal of the American Medical Association
October 17, 2007

Media is creating a tidal shift from private concern to public demand

Dirty Hospitals

Princeton schools report 3 MRSA infections
Staph warning sent to day care families
Hospital-Acquired Infections

The transmission, spread and treatment of infectious disease is a HUGE socio-economic issue.

So what’s being done about it?

In the U.S.
Medicare is stopping payments for preventable infections

We have solutions

- Groundbreaking EPA registration with public health claims

355 copper alloys with copper content greater than 60%
Against 6 disease causing pathogens:
- Meth.
- Staph.
- E. coli
- Enter.
- Pseud.
- Vanc. 

Laboratory testing shows that when cleaned regularly, this surface:
Continuously reduces bacterial* contamination, achieving 99.9% reduction within two hours of exposure.
Kills greater than 99.9% of Gram-negative and Gram-positive bacteria* within two hours of exposure.
Delivers continuous and ongoing antibacterial action, remaining effective in killing greater than 99.9% of bacteria* within two hours.
Kills greater than 99.9% of bacteria* within two hours, and continues to kill more than 99% of bacteria* even after repeated contamination.
Helps inhibit the buildup and growth of bacteria* within two hours of exposure between routine cleaning and sanitizing steps.
Copper Development Association

- Education
- Research
- Technical support
- Market development

Canadian Copper & Brass Development Association

- Our partner in North America
- Similar programs & focus
- French and English

Outline

1. Background
   CDA, Hospital Bacteria, Copper
2. Research & Results
   Testing, EPA Registration, Evidence-Based Design
3. Clinical Trials & Results
4. Applications
   Door Hardware, Bed Rails, Tables, etc.
5. Copper & Copper Alloys
   Mechanical properties, finish options

BACKGROUND
Background

- Transporting Water
- Coins
- Jewelry

Humankind has benefited from the antimicrobial properties of copper since ancient times

- Egypt (2000 BC) – Purify drinking water and treat wounds
- France (Mid 1800’s) – Copper workers immune to Cholera epidemic
- Aztecs – Used copper oxide and malachite for skin conditions
- India (Today) – Brass water jugs eliminate E. coli

Alloys

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<th>Element</th>
<th>Zn</th>
<th>Ni</th>
<th>Al</th>
<th>Sn</th>
<th>Si</th>
<th>Al</th>
<th>Cd</th>
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</table>
“Clean” is not measured visually

Live bacteria in a scratch on recently sanitized stainless steel surface

72 hours after inoculation with *E. coli*:

- **Brass Lockset**: Little bacterial growth
- **Stainless Steel Lockset**: Heavy bacterial contamination


Evidence-Based Design

- Compare copper to materials used in healthcare environments
- Ensure research protocols accepted by U.S. EPA and scientific community
- Test specific bacteria on copper alloys
- Register copper alloys with U.S. EPA as antimicrobial

### E. Coli O157:H7

<table>
<thead>
<tr>
<th></th>
<th>Time</th>
<th>CFUs</th>
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<tbody>
<tr>
<td>Stainless Steel</td>
<td>0 minutes</td>
<td>31,300,000</td>
</tr>
<tr>
<td>Copper</td>
<td>0 minutes</td>
<td>31,400,000</td>
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<tr>
<td>Stainless Steel</td>
<td>30 minutes</td>
<td>26,899,425</td>
</tr>
<tr>
<td>Copper</td>
<td>30 minutes</td>
<td>1,600,000</td>
</tr>
</tbody>
</table>
E. Coli O157:H7

Stainless Steel

Time 60 minutes

25,933,468 CFUs

2,740 CFUs

Copper

E. Coli O157:H7

Stainless Steel

Time 90 minutes

24,133,000 CFUs

0 CFUs

Copper

E. Coli O157:H7

Stainless Steel

Time 120 minutes

21,066,000 CFUs

0 CFUs

Copper

Bacteria

MRSA: Methicillin-resistant staphylococcus aureus

• An Antibiotic-resistant “Superbug”
• One of the most serious and widespread hospital-acquired infections

MRSA Viability: Copper vs. Stainless Steel

MRSA Viability: Ambient vs. Refrigerated
Copper alloys exhibit the same effect on all tested bacteria/pathogens

- Tested, registered with EPA
  - Escherichia coli O157:H7
  - Methicillin-resistant Staphylococcus aureus
  - Clostridium difficile
  - Enterobacter aerogenes
  - Pseudomonas aeruginosa
  - Vancomycin Resistant Enterococcus (VRE)

- Tested, not yet registered (cont.)
  - Penicillium chrysogenum
  - Cladosporium herbarum, Fusarium spp., A. Fumigatus, A. Flavus
  - Klebsiella pneumoniae
  - Acinetobacter baumannii
  - Carbide adriance
  - Salmonella enterica
  - Campylobacter jejuni
  - Mycobacterium tuberculosis
  - Rabies Virus, Norovirus, etc.
  - Legionella pneumophila
  - Cryptosporidium

Copper alloys exhibit antimicrobial efficacy was proven using three EPA test protocols

1. Efficacy as a sanitizer
   - It works – copper alloys kill > 99.9% of bacteria within 2 hours
2. Residual self--sanitizing activity
   - It won’t rub off – unlike coatings, solid copper alloy surfaces deliver continuous and ongoing antibacterial action
3. Continual reduction of bacteria
   - It works continually – copper alloys inhibit the growth and buildup of bacteria between routine cleaning and sanitization

Copper alloys exhibit the same effect even after repeated contamination
Copper alloys are always working

- Copper alloy surfaces* kill bacteria/pathogens between routine
- Copper alloy surfaces are compatible with standard cleaning practices/products
- Copper alloy surfaces must be cleaned/disinfected regularly like any other hospital touch surface
- Copper alloy surfaces supplement, not replace existing cleaning and infection control procedures
  
* Shall not be coated, waxed, or laquered, etc.

Real-world effects on bioload reduction were studied in the U.S.

- Clinical trials have proven:
  - Copper touch surfaces will lower total bacteria in ICU rooms
  
- Because 80% of infections are caused by touch* the healthcare industry assumes:
  - Less bacteria = lower risk of infections
  - Lower infection rates = saved lives & reduced treatment costs

* Tierno, 2001

Hypotheses:

- Antimicrobial Copper touch surfaces will lower total bacteria in hospital rooms
- Less bacteria = lower risk of infections
- Lower infections = saved lives, reduced treatment costs

Testing the Performance of Antimicrobial Copper Surfaces in the Clinical Setting

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine the baseline bio-load on 6 objects in patient rooms</td>
<td>Compare bio-load on copper vs. non-copper objects</td>
<td>Measure infection rates of patients in copper vs. non-copper rooms</td>
</tr>
</tbody>
</table>

December 2007

June 2011

Phase 1: Selection of Surfaces to Sample

**Surfaces Selected**
- Bed rails
- IV stands
- Over-bed tray tables
- Visitor’s chair (arms)
- Soaps/EtOH dispenser
- End table surface

**Surfaces Screened but not Selected**
- Laundry hamper
- Door handles
- Drawer pulls
- Faucet handles
- Keyboards
- IV poles
- Nurses call device

Sampling the built environment
- 100 cm² sterile templates placed over tested surfaces
- Exposed area wiped in a vigorous side to side motion using five strokes both ways (ten total) applying even pressure
- Bacteria liberated from wipe and plated

Phase 1: Results: Bio-load Evaluation (Non-Copper Surfaces)

Clinical environments carry an average microbial burden **35 times higher** than the levels commonly accepted as benign (under 500 CFU/100cm² - Dancer, 2004 and Malik, 2003)

Phase 2: Antimicrobial Copper Products Installed

Bed rails
- visitor’s chair
- data input monitor
- keypads
- IV poles
- over-bed tray tables
- visitor’s chair
Phase 2 Results: Principle observations

Copper surfaces consistently achieved the terminal cleaning standard of 5 Aerobic Colony Forming Units/cm² during clinical care.

MRSA was only isolated once from 3,384 copper surfaces... a 99.9% reduction vs. ICU control surfaces. (30 CFU/100 cm² vs. 29,029 CFU/100 cm²)

Antimicrobial Copper’s Performance in ICU Rooms Supported Hypothesis

Copper surfaces compared to controls:

**Bioburden: 83%**

Phase 3 preliminary results*:

**Infection-acquisition risk measurement**

This particular study found:

- **40% reduction** in the risk of acquiring an infection (p=0.039, n=651) for patients in rooms where some copper objects travelled out.
- **61% reduction** in the risk of acquiring an infection (p=0.006, n=541) for patients in rooms with copper rails and some copper objects travelled out.
- **69% reduction** in the risk of acquiring an infection for patients in rooms where copper objects never travelled out (p=0.008, n=462).

Study Conclusions

- Objects surfaced with copper consistently had bacterial burdens 83% lower than equivalent objects.
- Limited Placement of copper surfaces significantly reduced the rates of HAI and HAC in the MICU.
- Built Environment likely accounts for at least 50% of the HAIs seen in a MICU.

*Schmidt, Michael G. “Copper Surfaces in the ICU reduced the relative risk of acquiring an infection while hospitalized”, Slide Session: Innovative Approaches to Infection Controls, WHO 1st International Conference on Prevention & Infection Control, July 1, 2011, Geneva.
Applications

Some approved uses

- Bedrails, footboards
- Over-bed tables
- Bed-side tables in hospitals, extended care facilities, senior housing etc. (knobs, pulls, handles, surfaces)
- Handrails, (corridor/hallways) (Senior housing), automatic door push plates
- Stair rails, handrails, tubular railing, and supports, wall fittings T’s, elbows and brackets
- Bedrails, assistance rails
- Toilet safety rails
- Carts
- Door push plates, kick plates, rep plates, accessive plates
- Sinks: spigots, drains, sink trimmings
- Faucet, handles, spigot, drain control/lever
- Water fountains: bubbler head, drain strainer, handle
- Towel bars
- Showerheads
- Countertops and tabletops (non-food use only)
- Hinges, locks, latches, and trim
- Door stops, door pulls, and protector guards
- Toilet and urinal hardware, levers, push buttons
- Door exit stay for firing of exit
- Closures
- Vertical railing arms
- Vertical cover guards
- Protection bars
- Light switches, switch plates
- Visitor chairs: armrests, metal frames
- Thermostat covers, central lockers and wheels
- Telephone handsets and surfaces (housing), keypad
- And many more....

... are leading to market-ready products

... by companies ready to grab market share in healthcare facilities

- Denise Siegel Bronze
- Midbrook Medical
- MicroGuard AMC
- Colonial Bronze
- Wagner Companies
- Cooper Industries
  - Handrails, grab bars
  - Knobs, pulls, handles
  - Bed rails
  - Automatic door openers
  - Door push/kick plates
  - Trash canisters
  - IV poles
  - Shelving
  - Carts
- Just Manufacturing
- NuAire
- Elkay
- Rocky Mountain Hardware
- Pedigo Products
  - Dispensers
  - Tables & casework
  - Countertops
  - Switch Plates
  - Elevator handrails & controls
  - Wall coverings
  - Computer keyboards
  - Lockers
  - Trash receptacles

Potential Applications are LARGE

- Hospitals
- Schools
- Hotels
- Government Buildings
- Transportation
- Shopping Centers
- Gyms
- Restaurants
- Homes
Sinks

Handwash stations, scrub sinks,

Manufacturers: Just Manufacturing, Elkay Commercial Products

IV Poles

P-1003-4

Manufacturers: Pedigo, Midbrook Medical
Patient Transport

Manufacturer: Pedigo

Railings and Grab Bars

Manufacturers: Wagner Companies, Rocky Mountain Hardware, CuSalus by Colonial Bronze

Building Products

Manufacturers: Arrowhart, CuSalus by Colonial Bronze, Rocky Mountain Hardware

Work Surfaces

Manufacturers: Midbrook Medical, CuSalus by Colonial Bronze

Work Surfaces

Manufacturers: Midbrook Medical

Building Hardware

Manufacturers: Rocky Mountain Hardware, CuSalus by Colonial Bronze
Cabinet Hardware
Manufacturers: CuSalus by Colonial Bronze, Rocky Mountain Hardware

Equipment/Cart Handles
Manufacturers: CuSalus by Colonial Bronze

COPPER
Properties, Alloys, Color & Finish Options

Copper is Antimicrobial
Manufacturers: CuSalus by Colonial Bronze
Copper is malleable, ductile & durable

And it is sustainable

Durable
U.S. quarters, dimes and nickels are made of Copper Nickel

Alloys

Finish Options

Potential design applications are endless
The Bottom line!

- Cost of other materials $
- AMC Material 25% to 30%

Example:
Patient Transport Bed $4,000.00
+ $400 to $500

40% HAI reduction = 4 less HAI per year per room in the ICU @ a cost of $43,000.00* is a savings of $172,000.00 per year per ICU room

Payback of AMC can be measure in months not years

The Key Messages

- Hospital Acquired Infections & the Transmission of Infectious Disease are a Huge and Growing Problem
- US ICU HAI Rates*:
  - 500,000 infections/yr
  - $3.5 Billion/yr
  - 40,000 deaths
- Copper & Its Alloys Have Been Proven Effective in Killing the Bacteria That Cause These Problems
- Copper is Registered with the EPA
- We Have Creating Solutions Through Your Designs


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Are you ready to specify the products that help kill deadly bacteria?

For more information

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CDA Member Companies are ready to deliver registered products

Currently registered with the EPA to make public health claims

Questions????????