SELECTING MICROBICIDAL CHEMICALS FOR INFECTION CONTROL: BUYER BEWARE!

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INTRODUCTION & CONTEXT

- LIFE-STYLE/DEMOGRAPHIC CHANGES & INCREASED EXPOSURE & VULNERABILITY TO PATHOGENS
  - FASTER TRAVEL, LONGER LIFE, IMMUNOSUPPRESSION
- REVIVAL OF INTEREST IN ENVIRON. CONTROL
- MICROBICIDES BACKBONE OF ENVIRON. CONTROL
- INCREASING CONCERNS OVER MICROBICIDES
  - HUMAN & ENVIRONMENTAL SAFETY OF CHEMICALS
  - TESTING & LABEL CLAIMS OF MARKETED PRODUCTS
  - REGULATORY PROCESS

USES OF MICROBICIDES

- DRINKING WATER
- HYGIENE & FOMITES
- AGRICULTURE
- SEWAGE & BIOMED. WASTE
- PHARM. & OTHER INDUST.
- MICROBICIDES
- BIOFILMS
- SKIN
- MEDICAL, DENTAL & VETERINARY SETTINGS
- VACCINES
- ENVIRON. SURFACES
- FOOD PRODUCTION
- CONSUMER DEVICES (E.G., CONTACT LENSES)

MISCELLANEOUS

- MICROBICIDES IN INFECT. CONTROL
  - EVIDENCE FOR EFFECTIVENESS MAINLY CIRCUMSTANTIAL
  - VERY FEW FIELD STUDIES WITH UNEQUIVOCAL RESULTS
  - FIELD STUDIES DIFFICULT & EXPENSIVE
  - MISTAKES & MISUSE HAVE PRODUCED EVIDENCE FOR
    CRUCIAL ROLE OF MICROBICIDES IN INFECT. CONTROL
  - MORE DIRECT EVIDENCE OF BENEFIT IN PREVENTING
    SPREAD OF CONTAMINANTS IN MANUFACTURING
  - LAB-BASED DATA SHOWS SUCCESS IN INFECT. CONTROL

Issues to be addressed:

- WHY THE NEED FOR MICROBICIDES?
- WHAT SAFETY CONCERNS DO THEY POSE?
- ARE THERE CONCERNS WITH THEIR TESTING & LABEL CLAIMS?
- WHAT TRAITS SHOULD A BUYER/USER LOOK FOR IN A MICROBICIDE?
- WHAT CAN BE DONE TO DEAL WITH IDENTIFIED CONCERNS?

Acknowledgements:

- PAUL WEBBER
- CREM STAFF & STUDENTS

CREM WEBSITE:
WWW.ENVIRONMENTAL-MICROBIOLOGY.CA

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WHAT ARE THE CONCERNS?
- Focus on the following questions:
  - How safe are currently used microbicidal chemicals?
  - What is being done to address safety concerns?
  - How good are commonly used methods for testing microbicidal activity of chemicals?
  - What impact does such testing have on relevance & reliability of label claims?
  - Do test methods reflect field use of microbicicides?
  - What should a buyer/user look for in products?
  - What can infection control practitioners do to alleviate the concerns?

SAFETY OF MICROBICIDES
- Anything that can kill microbes can be potentially harmful to other life forms!
- Toxicity to humans & workplace safety
- Eco-toxicology is also a mounting concern
  - Persistent chemicals
  - Gender-bender chemicals
  - Sublethal levels in waste streams
  - 'Chembioaction' – deleterious outcome of combined effects of chemicals & microbes

HOW SAFE ARE MICROBICIDAL CHEMICALS?
- "Our Stolen Future" by Theo Colborn et al. (1997)
- Major efforts underway to deal with it
  - Canadian & U.S. strategies on endocrine disrupters
  - European Commission's directive on biocides for protecting human & environmental health
  - UNEP's strategy on chemical safety launched in Nov. 2003 & convention on persistent organic pollutants (POPs) in 2004

‘GREENING’ OF MICROBICIDES!
- Mounting concerns on safety of disinfectants
- Use of once common actives now restricted
- Additional actives are under review
- Increasing emphasis on oxidizers as disinfectants
  - Chlorine dioxide
  - Peracetic acid
  - Sodium dichloroisocyanurate (NaDCC)
  - Formulated hydrogen peroxide
- Issues of compatibility, pungent smell, etc.

WHAT IS GREEN OR SUSTAINABLE CHEMISTRY?
- Environmentally-friendly chemicals/processes that reduce waste while producing safer products with less use of energy
- Promotes renewable starting materials for a bio-based economy

FOUR OF TWELVE PRINCIPLES OF GREEN CHEMISTRY
- Design safer chemicals & products that are fully effective with little or no toxicity
- Use safer solvents & reaction conditions
- Design chemicals & products to degrade after use so that they do not accumulate
- Minimize potential for accidents such as explosions, fires & releases to the environment

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BODIES PROMOTING ‘GREEN’ CHEMISTRY (EXAMPLES)
- ECOLOGO: LAUNCHED IN CANADA IN 1988, IS NOW GLOBAL
- EU ECOLABEL: A SCHEME LAUNCHED IN EUROPE TO
  PROMOTE MAKING & MARKETING OF GREEN PRODUCTS
- ENVIRODESIC: EMPHASIS ON INDOOR AIR QUALITY
- SIERRA CLUB: PROMOTES ENVIRONMENTAL PROTECTION
- GREENGUARD INSTITUTE: THIRD-PARTY CERTIFICATION TO
  PROMOTE INDOOR AIR QUALITY
- GREEN SEAL: PROVIDES SCIENCE-BASED ENVIRONMENTAL
  CERTIFICATION STANDARDS

STATE OF MASSACHUSETTS ACT #2246 (2007)
- REQUIRES ENVIRONMENTALLY SAFE ALTERNATIVES TO
  HARMFUL CLEANING PRODUCTS
- TO REDUCE ASTHMA & OTHER HEALTH THREATS FROM EMISSIONS
  OF TOXIC CHEMICALS FROM CLEANING PRODUCTS USED IN
  SCHOOLS, HEALTHCARE FACILITIES, DAY CARE CENTERS, PUBLIC
  BUILDINGS & PUBLIC HOUSING
- CLEANING PRODUCT INCLUDE GENERAL PURPOSE
  CLEANERS, BATHROOM CLEANERS, GLASS CLEANERS,
  CARPET CLEANERS, DISINFECTANTS, FLOOR CARE
  PRODUCTS & HAND SOAPS

TESTING OF MICROBICIDES
- LABEL CLAIMS FOR MICROBICIDAL ACTIVITY ARE ONLY AS
  GOOD AS THE METHODS USED TO GENERATE THEM!
- MANY CURRENT METHODS ARE TECHNICALLY FLAWED &
  OFTEN FAVOR TESTED FORMULATIONS
- CONSTRAINED BY WHAT REGULATORS ACCEPT FOR DATA
- IDENTIFIED DEFICIENCIES IN TEST METHODS ARE:
  - INAPPROPRIATE SURROGATES & PRODUCT DILUENT
  - NO OR UNSUITABLE SOIL LOAD
  - CONTACT TIME OFTEN TOO LONG
  - CARRIER MATERIALS/DESIGN UNSUITABLE
  - NO HARMONIZATION BETWEEN JURISDICTIONS

INAPPROPRIATE OR EXAGGERATED LABEL CLAIMS
- UNDUE FOCUS ON BUG-OF-THE-WEEK WITH NO EVIDENCE
  FOR SPREAD VIA ANIMATE/INANIMATE SURFACES
- MANY ENVIRONMENTAL SURFACE DISINFECTANTS CLAIM
  ACTIVITY AGAINST CLOSTRIDIUM DIFFICILE
  - CLAIMS BASED ON TESTS WITH VEGETATIVE CELLS WHICH SURVIVE
    POORLY IN THE ENVIRONMENT
  - SUCH FORMULATIONS INEFFECTIVE AGAINST THE SPORES
  - INADVERTENT SPREADING OF CONTAMINATION OVER A WIDER AREA
    DURING CLEANING/DISINFECTION
  - RECENT RECALL OF CLAIMS BY U.S. ENVIRON. PROTECTION AGENCY

SPECTRUM OF MICROBICIDAL ACTIVITY
- IN MOST SITUATIONS, TARGET PATHOGEN(S) IS NOT KNOWN
- THEREFORE, PRODUCTS WITH LIMITED MICROBICIDAL
  ACTIVITY MAY NOT PRODUCE DESIRED BENEFIT
  - THEY MAY INDEED BE MORE HARMFUL
- FASTER-ACTING FORMULATIONS WITH A BROADER
  SPECTRUM OF ACTIVITY MORE DESIRABLE
- HISTORICAL BASIS FOR FOCUS ON CLAIMS WITH
  BACTERICIDAL ACTIVITY
  - BACTERIA AT ONE TIME MORE COMMON & EASIER TO WORK WITH
  - VIRUSES, MORE DEMANDING TO HANDLE, NOW OF MAJOR CONCERN
  - FUNGI ARE ALSO AMONG EMERGING PATHOGENS

FIELD APPLICATION OF MICROBICIDES
- LAB TESTING DOES NOT REFLECT FIELD USE
- WIPEING OF SURFACES ENTAILS VERY SHORT CONTACT
  TIMES WITH MINISCULE VOLUMES OF PRODUCT (TABLE)
- MAY IMPACT MICROBICIDAL ACTIVITY


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<th>FORMICA</th>
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<td>DISTILLED WATER</td>
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<tr>
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<td>2.06±0.62</td>
<td>1.54±0.13</td>
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<td>0.29±0.03</td>
<td>0.30±0.02</td>
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<tr>
<td>DISINFECTANT</td>
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<td>1.78±0.12</td>
<td>1.73±0.06</td>
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<tr>
<td>SQUEEZED</td>
<td>0.24±0.03</td>
<td>0.26±0.01</td>
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*SATTAR ET AL., UNPUBLISHED DATA

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**Desired Traits in a Microbicide**
- As safe as possible for humans & environment
- Non-allergenic & non-sensitizing
- Fast-acting, non-staining, perfume-free
- Free of volatile organics (VOC's)
- Safe to transport & store
- Non-corrosive & materials compatible
- Work in small volumes/unit surface area
- Cost-effective with clear use directions

**Emerging Issues**
- Increasing demand for microbicides
- Emerging & re-emerging pathogens
- Societal changes & increased vulnerability
- Post-antibiotic era (?)
- Pressure for regional/global harmonization
- Is increasing use of treated articles a good thing?
- Disinfectants & antibiotic resistance (?)
- Better methods of microbicide testing/application

**Recommendations**
- Infection control practitioners must:
  - Stop asking for irrelevant product claims
  - Demand safer products & better labels
  - Store, use & dispose of microbicides properly
  - Convince managers to think beyond cost
  - Report problems & failures
  - Ensure proper training of house-keeping staff
  - Urge regulators to update registration rules

**Concluding Remarks**
- Unrealistic expectations from microbicides
- Microbical chemicals will be subjected to greater & greater scrutiny
- Antimicrobial activity will be only one component in their acceptance & use
- A major review of issues needed to come up with safer yet effective microbicides
- End-users must take a lead because they represent the true consumer power!

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**The Next Few Teleclasses**

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<th>Topic</th>
<th>Speaker/Details</th>
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<td>15 May 08</td>
<td>Advance Events in Duluth</td>
<td>Dr. Matthew Andino, CDC</td>
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<tr>
<td>22 May 08</td>
<td>Behavioral Dependencies: Manual vs. Mechanical</td>
<td>Speaker: Orrie van Kroppenberg/Sondra, International Consultant Infection Prevention and Hygiene, The Netherlands</td>
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<tr>
<td>19 Jun 09</td>
<td>Environmental Sampling: Methods and Strategies</td>
<td>Dr. Lynn Sellas, CDC</td>
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<td>25 Jun 09</td>
<td>Youth Health: Preventing Regional Low Scores</td>
<td>Speaker: Dr. Steve McHale, Auckland District Health Board</td>
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<td>25 Jun 09</td>
<td>CRIC Infection: The CDC Examination Process and Computer-Based Testing</td>
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<td>17 Jul 08</td>
<td>Free: Track the Community-Associated MRSA: Is That's Up &amp; Down Line</td>
<td>Speaker: Dr. Rachel Gerault, CDC</td>
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<td>22 Jul 08</td>
<td>Free: Track the Progress Report from the Chief Nursing Officer</td>
<td>Speaker: Christine Bradley, Brit Irish Department of Health</td>
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