Antimicrobial Properties of Silver Nanoparticles
Objective

You will learn about:

• Nanotechnology
• Making nanoparticles
• Applications of nanoparticles
Motivation

• Any technology involving features with sizes between 1 and 1000 nanometers can be considered nanotechnology.
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• Nanotechnology is an emerging industry which is bringing us exciting new products and promises to change the way we live and work in the future.
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Food Containers

- Blue Moon Goods storage containers

http://www.bluemoongoods.com/silver_nanoparticle_food_containers.htm
Baby Bottles

• Baby Dream Silver Nano Poly products

http://babydream.en.ec21.com
Toothpaste

- Nano toothpaste

http://www.gnsnanogist.com/
Toothbrush

- Toothbrush by Songsing Nanotechnology

http://www.ssnano.net/ehtml/detail1.php?productid=73
Cutting Board

- Antibacterial Effect by Nano Silver Clean

http://www.adox.info/?doc=shop/item.php&it_id=000123
**Computer Mouse**

- IOGEAR's Personal Security Mouse

Antibacterial Athletic Socks

- Eliminate smelly feet with antibacterial and antifungal socks.

http://www.sharperimagebest.com/zn021.html
Cotton Sheets

• AgActive sheet sets are not only comfortable, but they kill bacteria too!

http://www.agactive.co.uk/index.cfm/fuseaction/product.display/Product_ID/8/.htm
Washing Machine

• Silver Nano washing machine comes with a silver wash option.

Today's Activities

• Make nanoparticles.
• Soak filter in nanoparticles.
• “Inoculate” plate.
• Check results.
• Put 2 ml .5 mM AgNO₃ in a test tube.
  – Start with a compound that has silver in it.
  – Our solution is silver nitrate.
How to Make Silver Nanoparticles

• Put 2 ml .5 mM AgNO₃ in a test tube.
• Heat in boiling water bath for 5 minutes.
  – Heating it will speed the reaction.
• Put 2 ml .5 mM AgNO₃ in a test tube.
• Heat in boiling water bath for 5 minutes.
• Add 5 drops of 1% sodium citrate.
  – Carefully add the sodium citrate; the solution is **HOT!**
  – Allows gold to form stable nanoparticles
How to Make Silver Nanoparticles

- Put 2 ml .5 mM AgNO₃ in a test tube.
- Heat in boiling water bath for 5 minutes.
- Add 5 drops of 1% sodium citrate.
- Continue heating — wait for silver nanoparticles to form.
  - Watch for a change in color to indicate the silver has formed.
  - Let it heat a few more minutes to be sure the color change is complete.
How to Make Silver Nanoparticles

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- Heat in boiling water bath for 5 minutes.
- Add 5 drops of 1% sodium citrate.
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Growth of Bacteria

• Bacteria may grow as a group = **colony**

• Bacteria may cover surface of plate = **lawn**
Bacterial Antibiotic Sensitivity

• Antibiotics may inhibit the growth of some bacteria.
• Evidence of this is a “halo”.
• A halo indicates a zone where bacteria are not present.
Procedure

• Cut filter paper into small squares.
• Place squares in a petri dish and pour silver nanoparticles over them.
• Let the squares soak for about 10 minutes.
Procedure

• Mark the bottom of an agar plate with your initials, divide the bottom into sections, and label.

• Put 1 to 2 drops of bacterial culture on the plate.

• Spread the drops.
Procedure

• Place your nanoparticle soaked filter paper squares and your control(s) in the designated areas.

• Incubate your plate for 24 hours at 37°C.
• The following slides display results and are included only as a teacher resource for a discussion after the experiment has been completed.
Results
Results
Results
Results
SEM of Bacteria
SEM of Bacteria