Test the Efficacy of Soap and Disinfectant

Science Film Festival — Knowledge Through Entertainment

FILM

- House of Little Scientists: How Germs Spread
- Quarks - How Clean Are Our Toilets?
- Xenius: Epidemics and Society – How They Influence Our Coexistence

KEY OBJECTIVES

1. To understand a simple method for testing the antibacterial effectiveness of a substance
2. To understand how the different types of disinfectants affect microbes

INTRODUCTION

Hand washing is most recommended and widely practiced, a kind of self-medication that prevents diseases. It not only helps the individual who practices it, but also others who come in contact with us. Hand washing is a globally recommended hygienic act. It is recommended by every medical professional and is extremely useful in preventing diseases especially during this COVID-19 pandemic, people are using many types of soaps and a variety of hand sanitizers for hand washing. It is interesting to explore that are all soaps are equally effective in killing microbes, hand sanitizers really work well. In this activity you will make a medium from the materials readily available at home and test the present of microbes and the effect of soap and sanitizers by growing colonies of bacteria in the medium you made.

GUIDING QUESTIONS

- Can you test the efficacy of disinfectant at home by using materials readily available at home?
- Are soaps really effective in eliminating the microbes?
- Are antibacterial soaps works better than normal soap?
- Will some disinfectants works better than others?
- Will 60 percent alcohol hand sanitizers really work?

TOPICS

Biology | microbiology | mycology | bacteriology

KEYWORDS

Disinfectant | anti-bacterial | culture media | colonies | pathogens | bacteria | microbes

LEVEL

Secondary School

RESOURCE TYPE

Experiment

INTENDED AUDIENCE SIZE

5–10 Students

MODE OF DELIVERY

Small Group

TIME FOR ACTIVITY

45 min.

TIME FOR INCUBATION

5 days

most clinical pathogens grow easily over 24 to 48 hours in disposable plate media, but several bacteria species require a much longer time, whereas most routine laboratories maintain cultures

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MATERIALS

- Disposable plates
- Water (250ml)
- Agar (gelatin)
- Chicken (infusion from 250g), 5g/l (must be the boiled broth)
- Sugar
- Ordinary Soap (Normal Soap)
- A soap containing chloroxylenol (e.g. – Dettol)
- Hand sanitizer
- Antibacterial soap

PREPARATION

1. To prepare a general growth medium, boil some water, and in a hear resistant vessel add 2 teaspoons of gelatin or agar powder to each cup (250ml) of hot water and gently stir until dissolved
2. To grow a range of microbes, add a teaspoon of table sugar for each cup of liquid and dissolve, and add about 50ml of strong hot clear meat broth.
3. Mix gently, but quickly, and while still hot pour into your disposable plates, to a depth of between 5 and 10mm. While hot, cover with a sealing lid or clear plastic film, and keep in a cool location (fridge if possible) until ready to introduce the bacteria.

TASKS/PROCEDURE

1. Four culture plates prepared as above. (Including control)
2. Introduce your bacterial culture to the disposable plate (make a suspension of you source of bacteria in a small volume of water and flood evenly across the plate and pour off any excess).
3. Cut the blotter paper into small “sensitivity squares.” Use permanent ink to label the squares for the different types of hand cleaners you are going to test, e.g., “R” for regular soap, “A” for antibacterial soap, and “S” for hand sanitizer. Using tweezers, dip each square into the appropriate cleaner. Blot the excess cleaner on a paper towel and then place the squares on the agar in the “Test” Disposable Plates. Add one square of plain blotter paper to test if blotter paper by itself has any effect. Don’t put any squares in the “Control” dish – this one will show you what the bacterial growth will look like without any soap.
4. Put the dishes in a dark, room-temperature place like a closet and leave them undisturbed for a few days.

Here is another way to make containers to keep media.

1. Take a 1liter used water bottle with cap and clean it. It can be used in the place of disposable paper plates.
2. Put culture media from the mouth of the bottle and keep it in horizontal position.
3. You can Put your test material with cotton swap through the mouth of bottle and close the cap tightly.

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Read the following instruction and fill up the observation sheet

1. The rate of bacteria growth in your disposable plates will depend on temperature and other factors
2. Check your cultures after 7days before recording your data.
3. You will see multiple round dots of growth; these are bacteria colonies.
4. There may be several types of bacteria growing in the dishes. Different types of colonies will have different colors and textures
5. For each soap test, count and record the number of bacteria colonies each dish.
6. To see how effective each soap was, divide the number of colonies in the test dish by number of colonies in the control dish, then subtract the result from 1 and write the answer as a percentage.
7. For example, if your control dish had 100 colonies and your soap test dish had 30, the soap eliminated 70% of the bacteria: 1 – (30÷100) = .7 = 70%

Note: Observation sheet is provided at the end of the document.

FOSTERING DISCUSSIONS

1. We can discuss about types of micro-organisms and their characteristics.
2. What are the types of micro-organisms?
3. Can micro-organisms help us? How?
4. How micro-organisms harm us? Give examples.
5. What are the differences between virus and bacteria?
6. Why corona virus can be easily destroyed by soap and water?
7. How do viruses get their names?
8. What are micro biomes?
9. What are probiotics? Why are they so popular these days?
10. What are the differences between sanitizer, disinfectant, antibacterial agent and antibiotics?

Some information below also helps teachers to discuss further with students.

While we are talking about micro-organisms, we cannot forget fungus. A fungus is any member of the group of eukaryotic organisms that includes microorganisms such as yeasts and molds, as well as the more familiar mushrooms. These organisms are classified as a kingdom, separately from the other eukaryotic kingdoms, those being Plantae, Animalia, Protozoa, and Chromista.

A characteristic that places fungi in a different kingdom from plants, bacteria, and some protists is chitin in their cell walls. Fungi, like animals, are heterotrophs; they acquire their food by absorbing dissolved molecules, typically by secreting digestive enzymes into their environment. Fungi do not photosynthesize. Growth is their means of mobility, except for spores (a few of which are flagellated), which may travel through the air or water. Fungi are the principal decomposers in ecological systems. These and other differences place fungi in a single group

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of related organisms, named the *Eumycota* (*true fungi* or *Eumycetes*), which share a common ancestor (from a *monophyletic group*), an interpretation that is also strongly supported by molecular phylogenetics. This fungal group is distinct from the structurally similar myxomycetes (slime molds) and oomycetes (water molds). The discipline of biology devoted to the study of fungi is known as mycology (from the Greek μύκης *mykes*, mushroom). In the past, mycology was regarded as a branch of botany, although it is now known fungi are genetically more closely related to animals than to plants.

So, the question here is "Can soap kills Fungus?" Some soaps cannot kill fungus otherwise can multiple and growth more fungus. But these days some cosmetic company producing anti-fungal soaps like Tea Tree Oil Soap, Miconazole, Ketoconazole. Antifungal soap contains fungus-fighting ingredients like miconazole and ketoconazole, but many use natural ingredients like tea tree oil or eucalyptus. They can help with a variety of fungal infections, including ringworm, jock itch, and athlete's foot. Many fungal infections originate in public pools or locker rooms, so anyone who swims or works out regularly should consider using an antifungal soap to keep infections under control.

SAFETY INSTRUCTIONS

- **Treat all microorganisms as potential pathogens.**
  While the majority of micro-organisms are not pathogenic to humans and have never been shown to cause illness, under unusual circumstances a few microorganisms that are not normally pathogenic can act as pathogens. Treat all microorganisms–especially unknown cultures–as if they were pathogenic. A student who has a compromised immune system or has had a recent extended illness should talk with his or her instructor before working in the microbiology laboratory. (*Do not do this experiment if you already sick*)

- **Sterilize equipment and materials.**
  All materials, media, tubes, plates, loops, needles, pipettes, and other items used for culturing microorganisms should be sterilized by autoclaving. Otherwise, use commercially sterilized products. Understand the operation and safe use of all equipment and materials needed for the laboratory.

- **Disinfect work areas before and after use.**
  Use a disinfectant, such as a 10% bleach or 70% ethanol solution, to wipe down benches and work areas both before and after working with cultures. Also be aware of the possible dangers of the disinfectant, as 70% ethanol can catch fire around open flame or high heat sources. Bleach, if spilled, can ruin your clothing. Either alcohol or bleach can be dangerous if splashed in the eyes. You should know where the nearest eyewash station and sink are located.

- **Wash your hands.**
  Use a disinfectant soap to wash your hands before and after working with microorganisms. Non-disinfectant soap will remove surface bacteria and can be used if disinfectant soap is not available. Gloves may be worn as extra protection.

- **Never pipette by mouth.**
  Use pipette bulbs or pipetting devices for the aspiration and dispensing of liquid cultures.

- **Do not eat or drink in the experiment area (lab), nor store food in areas where microorganisms are stored.**
  Never eat or drink in the laboratory while working with microorganisms. Keep your fingers out of your mouth and wash your hands before and after the laboratory activity. Cover any cuts on your hands with a bandage. Gloves may be worn as extra protection.

- **Label everything clearly.**
  All cultures, chemicals, disinfectants, and media should be clearly and securely labeled with their names and dates. If they are hazardous, label them with proper warning and hazard information.

- **Autoclave or disinfect all waste material.**
  All items to be discarded after a class, such as culture tubes, culture plates, swabs, toothpicks, wipes, disposable transfer needles, and gloves, should be placed in a biohazard autoclave bag and autoclaved 30 to 40 minutes at 121° C at 20 pounds of pressure. If no autoclave is available and you are not working

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with pathogens, the materials can be covered with a 10% bleach solution and allowed to soak for at least 1 to 2 hours.

- **Clean up spills with care.**
  Cover any spills or broken culture tubes with a 70% ethanol or 10% bleach solution; then cover with paper towels. After allowing the spill to sit with the disinfectant for a short time, carefully clean up and place the materials in a biohazard autoclave bag to be autoclaved. Wash the area again with disinfectant. Never pick up glass fragments with your fingers or stick your fingers into the culture itself; instead, use a brush and dustpan. If working with animal or plant pathogens, keep the area clear and notify your instructor.

POSSIBLE EXTENSIONS

After the main activity, educators and students can make media culture and ready to apply their skills in doing different types of activities to learn more about microbes. Students and teachers will find following activity interesting.

OBJECTIVES

1. To investigate how different disinfectants work in killing germs on cutting board.

RESEARCH QUESTIONS

- Do disinfectants kill germs?
- Do some disinfectants work better than others at killing germs?

MATERIALS

- Large plastic cutting board
- Marker
- Masking tape
- 3 disinfectant solutions
- Clean spray bottle
- Water
- Latex gloves
- Raw hamburger or chicken
- Paper towels
- Petri dishes with nutrient agar
- 4 cotton swabs

EXPERIMENTAL PROCEDURE

1. Gather the necessary materials.
2. Use masking tape to divide the cutting board into four equal sections. Number the sections 1–4.
3. Pour water in the spray bottle. Number the water bottle number 1. Number the disinfectants numbers 2 through 4.
4. Label the petri dishes 1 through 4. Do not open them or you will contaminate them.
5. Put on the latex gloves. Smear a small bit of raw hamburger or chicken on each space of the cutting board. Try to apply the same amount to each section. Throw the remainder of the hamburger or chicken into the garbage. Let the cutting board sit undisturbed overnight.
6. Spray some water on a paper towel and rub over section one. Repeat spraying each disinfectant on a separate paper towel. Rub over the appropriate section. Allow the cutting board to dry completely. Throw away the used paper towels.

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7. Using a cotton swab, gently swipe one end across one section of the cutting board.
8. Do not allow the cotton swab to touch anything else. Open the lid of the petri dish and swipe the cotton swab across the agar surface. Immediately replace the lid. Do not let the lid touch anything else.
9. Repeat steps 7 with the other sections of the cutting board.
10. Place the petri dishes in a warm place where they can remain undisturbed from 2 days.
11. After 5-7 days, record your findings and draw your conclusion.

AUTHORS AND SOURCES

Dr. Mya Thein, Myanmar

1. Science nomad: Investigating microbes and anti-microbial compounds
2. Science Project: How do disinfectant works?

→ www.sciencebuddies.org/science-fair-projects/references/microorganisms-safety

→ www.femina.in/wellness/health/fungal-infections-and-their-home-remedies-104090.html

→ www.homestratosphere.com/types-of-soap/

Observation sheet for main activity

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No	PLATE	NUMBER OF COLONIES	HOW MUCH BACTERIA ELIMINATED
1	Control	100	0
2	Plate with ordinary soap		
3	Soap with (chloroxylenol)		
4	Hand Sanitizer		

1. **Which type of soap was most effective at eliminating bacteria according to your observation? What is the reason behind this? Give your hypothesis.**

2. **Does antibacterial soap work better than ordinary soap?**

3. **Does hand sanitizer is effective? Why or why not? Does hand sanitizer replace soap and water? Why or why not?**