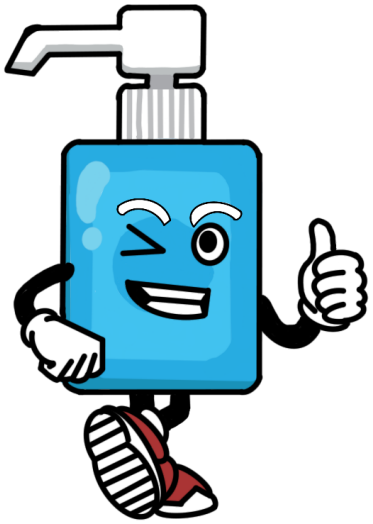
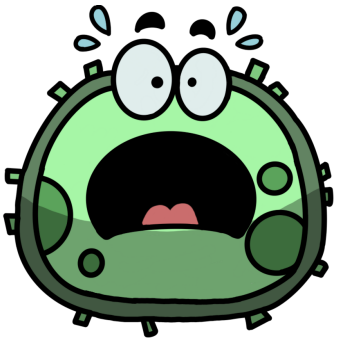
Germ Frenzy!

Which is the Best Brand of Hand Sanitizer?





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Background and Research

Due to the COVID-19 pandemic, hand sanitizers have been flying off store shelves. When soap and water are not available, hand sanitizers can help get rid of germs. However, the CDC recommends using hand sanitizer containing at least 60% ethanol or isopropanol alcohol or both and if your hands aren't visibly dirty or greasy.
Ethanol, the most common alcohol ingredient, is effective against viruses, while propanols are effective against bacteria. It is important to note that hand sanitizers can quickly reduce the number of microbes on our hands, but they do not eliminate all types of germs. Hand sanitizers do not remove harmful chemicals like pesticides or heavy metals from hands.

Purpose

Hand sanitizer has been a big help in protecting us from COVID-19. At the local stores, there were many different brands of hand sanitizer, but I didn't know which to choose.

I wanted to know which was the most effective, so I decided to test a few different brands by conducting a science experiment.

Hypothesis

My hypothesis is that Purell will be the best brand of hand sanitizer. It is very popular, and costs more. Purell has become so popular it is a verb! Sometimes people say "I am going to go Purell my hands" when they are going to use hand sanitizer. Also, it might have more effective ingredients because it is expensive. Purell says on the label that it kills 99.99% of illness causing germs. In addition, Canada.ca says that Purell is authorized by Health Canada and it is used in Hospitals.

Materials

- 10 petri dishes
- 5 different brands of hand sanitizer
- 10 sterile cotton swabs
- Some pairs of hands
- Dehydrated nutrient agar
- 350mL of distilled water
- A spoon
- A glass measuring cup
- Microwave
- A Sharpie Marker (for labeling)

Procedure

Independent variables

- the different brands of hand sanitizers being used

Dependent variables

- the amount of growth of bacteria on the petri dishes

Controlled variables

- 10 identical sterile petri dishes with equal amounts of agar
- 10 identical sterile swabs
- Agar was produced in the same batch
- A nickel-sized amount of hand sanitizer used for each test
- All the petri dishes were placed in the same warm place together

Steps

1. Label the petri dishes with a Sharpie marker. Each brand test gets two petri dishes - one labeled “(name of brand) Control” and one labeled “(name of brand) Test”.

2. Prepare the agar:
    a. Mix Agar powder and 350mL of distilled water in a glass measuring cup
    b. Heat the agar mixture in the microwave until it boils (approx. 2 minutes)
    c. Stir mixture with spoon and let it cool for 20 minutes
    d. Pour equal amounts of agar in each petri dish
    e. Put the lids on each petri dish and let the agar set for 60 minutes

3. Swab an unclean hand with a sterile cotton swab and apply the swab to the petri dish by gently swiping the swab across the entire surface of the agar. This is your control sample.

4. Apply a nickel-sized amount of hand sanitizer to hand and thoroughly rub all over hands, fingers and wrist until dry. Swab the cleaned hand with a new sterile cotton swab and apply the swab to the petri dish by gently swiping the swab across the entire surface of the agar. This is your test sample.

5. Repeat steps 3 and 4 with each brand of hand sanitizer being tested.

6. Place the dishes in a warm place and observe bacteria growth daily.

Hand Sanitizer Characteristics

	Purell	Natural Concepts	Lifebuoy	Hand MD	Medicare (Dollarama brand)
Cost	$3.99	$2.49	$1.97	$2.49	$0.75
Size	59ml ($0.07 per ml)	59ml ($0.04 per ml)	59ml ($0.03 per ml)	59ml ($0.04 per ml)	60mL ($0.01 per ml)
Alcohol %	70% Ethyl Alcohol	65% Ethyl Alcohol	62% Ethyl Alcohol	62% Ethyl Alcohol	70% Ethyl Alcohol
Consistency	Semi-Thick	Semi-Thick	Thick	Watery	Watery
Germ Kill claim	99.9%	99.9%	Kills Germs and Harmful Bacteria	99.9%	Destroys Harmful Bacteria
Fragrance	Pleasant	Pleasant	Unpleasant	Unpleasant	Unpleasant
User Experience	Pleasant, dried in 5 seconds, not sticky, hands felt clean after use	Pleasant, dried in 10 seconds, not sticky, hands felt clean after use	Not pleasant, dried in 15 seconds, sticky, hands felt clean after use	Not pleasant, dried in 20 seconds, sticky, hands felt slimy after use	Not pleasant, dried in 30 seconds, slimy, hands did not feel clean after use

Daily Observations

Day 1	No visible bacterial growth observed on Petri dishes

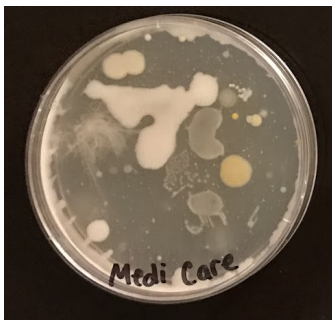
Day 2	Control Coverage	Test Coverage	Description Control	Description Test
Purell	50%	5%	One large white colony with many tiny white spots	9 small white spots (0.3-0.5cm) and a few tiny white specks
Natural Concepts	30%	5%	One large white colony with a lot of tiny white specks	2 white colonies (0.5-1 cm) with many tiny white specks
Lifebuoy	40%	15%	One large white colony with multiple white spots	Growth around half the perimeter of the petri dish and 3 white spots (0.3-0.5cm) and many tiny white specks
Hand MD	50%	15%	One large white colony with many small white spots	Medium white colony with a couple small white spots (0.3-0.5cm) and many tiny white specks
Medicare	40%	15%	One large white-ish speck with lots of tiny white specks	One large white colony with a translucent spot and many whites spots and specks

Day 3	Control Coverage	Test Coverage	Description Control	Description Test
Purell	60%	10%	One large white colony with many tiny white spots and a small light-yellow spot	9 small white spots (0.5cm) with many tiny white specks and a small yellow spot
Natural Concepts	40%	10%	One large white colony with a large amount of tiny white specks	2 medium white colonies (0.5-1cm) with many tiny white specks and a couple small translucent spots
Lifebuoy	40%	20%	One large white colony with multiple white spots, two tiny yellow spots and a medium translucent spot	Growth around half the petri dish and 3 medium white colonies (0.5cm) with a couple of small white spots and many tiny white specks
Hand MD	60%	20%	One large white colony with many small white spots and some small yellow-ish spots	Medium white colony (0.5cm) with a couple small white spots and many tiny white specks and a small orange spot
Medicare	60%	20%	One large white-ish speck with lots of tiny white specks and many small yellow spots	One large white colony with a 3 translucent spots (1cm), and many whites spots

Day 4	Control Coverage	Test Coverage	Description Control	Description Test
Purell	70%	15%	One large white colony with lots of small white spots and one yellow spot	11 medium white spots (0.5cm) with many tiny white specks a small yellow spot
Natural Concepts	60%	15%	One large white colony with a large amount of tiny white specks and three yellow spots	2 white colonies (0.5-1cm) with many tiny white specks and many translucent colonies
Lifebuoy	60%	30%	One large white colony with many small white spots, 2 yellow spots and 2 translucent spots	Increased growth around the perimeter of the petri dish (70%) with a couple of white spots, 2 yellow spots and many tiny white specks
Hand MD	60%	30%	One large white colony with many white spots and more yellow spots	Medium white colony (0.5cm) with a lot of white spots and many tiny white specks and a small orange spot
Medicare	70%	40%	One large white-ish colony with a couple of white spots and a lot of small yellow spots	One large white colony with 4 translucent spots (1cm) and some light-brown spots

Day 5	Control Coverage	Test Coverage	Description Control	Description Test
Purell	70%	20%	One large white colony with lots of small white spots and one yellow spot	11 medium white spots (0.5cm) with many tiny white specks a small yellow spot
Natural Concepts	60%	20%	One large white colony with a large amount of tiny white specks and three yellow spots	2 white colonies (0.5-1cm) with many tiny white specks and many translucent colonies
Lifebuoy	60%	30%	One large white colony with many small white spots, 2 yellow spots and 2 translucent spots	Increased growth around the perimeter of the petri dish (70%) with a couple of white spots, 2 yellow spots and many tiny white specks
Hand MD	60%	30%	One large white colony with many white spots and more yellow spots	Medium white colony (0.5cm) with a lot of white spots and many tiny white specks and a small orange spot
Medicare	70%	40%	One large white-ish colony with a couple of white spots and a lot of small yellow spots	One large white colony with 4 translucent spots (1cm) and some light-brown spots

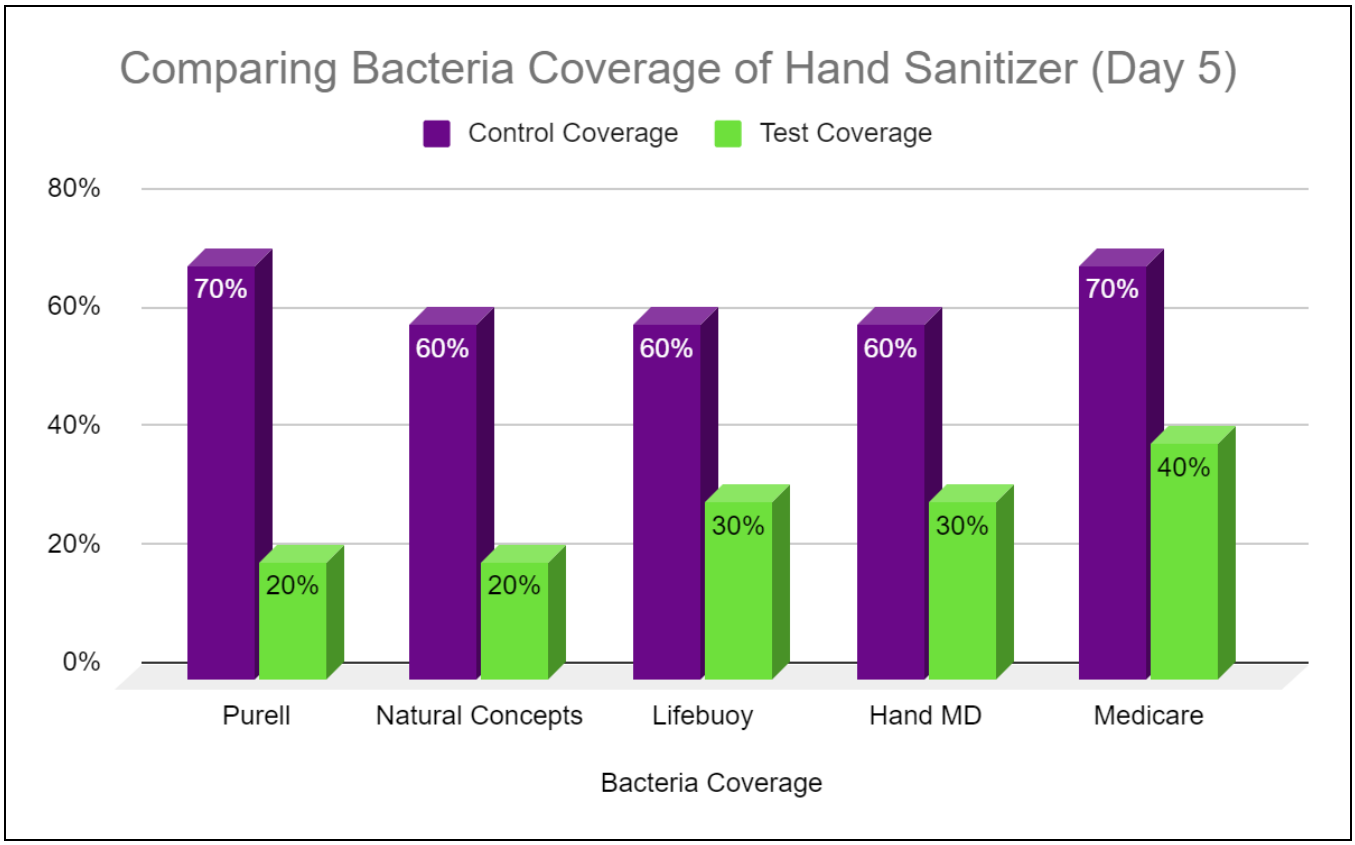
Photos (Day 5 - Last day of Observations)
Control on left, Test on right



Results

My results showed that Purell was the most effective brand of hand sanitizer. The graph illustrates that Purell had the largest visible difference in bacteria coverage between the control and test.
It was also interesting to see that although Purell and Medicare both contained 70% alcohol, Medicare was not as effective.

Day 5	Control Coverage	Test Coverage	Alcohol %
Purell	70%	20%	70%
Natural Concepts	60%	20%	65%
Lifebuoy	60%	30%	62%
Hand MD	60%	30%	62%
Medicare	70%	40%	70%



Conclusion

I recommend Purell brand when choosing hand sanitizer.

My results showed that Purell is the best brand of hand sanitizer because there was the largest visible difference between the amount of bacteria on the control dish compared to the test dish. This shows that Purell was more effective in eliminating the bacteria.
Purell also had the highest percentage of alcohol (of brands tested) and was the most pleasant to use.
If you need to use hand sanitizer to clean and kill harmful bacteria and germs from your hands, you should definitely use Purell. As mentioned previously, Purell brand is authorized by Health Canada and used in hospitals.

There are a few things to keep in mind when it comes to hand sanitizers

- Alcohol-free formulations might be not as effective, according to the CDC. These products may not work as well on many germs and might only reduce their growth instead of killing them.
- When applying hand sanitizer, make sure you are using the proper technique and use enough to cover all surfaces of your hands and rub your hands together until they're totally dry. Do not use hand sanitizer when hands are greasy, visibly dirty or you have chemicals on your hands.
- Antibacterial" products are not the same as hand sanitizer. Antibacterial products contain triclosan and triclocarban, which may be harmful and don't have proven effectiveness. These chemicals may also contribute to creating antibiotic-resistant bacteria, which the alcohol in hand sanitizers does not do.
- Hand sanitizers can cause skin dryness. Using too much hand sanitizer can cause irritation because of the alcohol ingredients.

Ways to Improve this Experiment

There are some ways I could have improved my experiment:

- Testing a non-alcohol based brand of hand sanitizer
- Increasing the variety of brands used in my experiment
- Having a petri dish with nothing swabbed, to check for possible contamination in the agar preparation
- Using the recommended amount of hand sanitizer if noted on the label
    - I used the same nickel-sized amount for each brand
- Making sure I used the proper hand rubbing procedure consistently when applying the hand sanitizer
- Ability to improve measuring the bacteria coverage (I visually estimated how much bacteria coverage was seen on the petri dishes)

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