Cleanliness is Key!

What Kind of Surface Cleaner Harbors the Least Bacteria?

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Abstract

This study is related to how important working cleaners of all kinds are with all of the sicknesses like covid going around. This is very important because the world needs to know if the surface cleaners we know and trust actually kill the bacteria they promise to. Previous studies have shown that bacteria can be very harmful to the human body and if we don't find a way to stop these harmful bacteria, more people will die from infections and illnesses. We started this experiment to see which surface cleaner actually works best against bacterial growth.We grew the bacteria for two weeks in petri dishes. After that, we dropped three drops of surface cleaner on 3 small sterile discs in each dish, spread out from each other. After fifteen days of collecting our data five days at a time, we were able to determine which of the brands we had given the most protection against bacteria. Our evidence did not support our hypothesis and on the fifteenth day of measuring, the Lysol’s zone of inhibition was an average of 2.4 centimeters in diameter which was way better than the Mr. Clean’s final average zone of inhibition was 1.1 centimeters in diameter.

Introduction:

Bacteria Facts

Bacteria is a microscopic (very, very small) single celled organism made up of nutrients, water, gasses, wastes and enzymes. (Aparna Vidyasagar, and Stephanie Pappas, 2021) Did you know if you took all of the bacteria in the world and stretched it out in a line then it would go for about 10 billion light years? (Aparna Vidyasagar, and Stephanie Pappas, 2021) Bacteria look like spirals, balls or straight lines. (Aryal Sagar, 2022) Bacteria is a living thing. One thing that supports the growth of bacteria is nutrient agar. (Biotrend.com) Nutrient agar is made up of agar, peptone and beef extract. (Biotrend.com)

Bacteria have a pH of around 5.5-9.0. (Alexander Silberman, 2011) Bateria has been on the planet earth for more than 3.5 billion years. (Brittanica.com) You contain the same amount of bacteria cells and human cells in your body. (Allison Abbott, 2016) In 1674, humans discovered bacteria. (Aria Nouri) Fun fact yogurt is made with bacteria. (Seiji Nagaoka, 2019)

Some bacteria are good for your survival, but some make you sick! One example of a healthy type of bacteria is probiotics. (Daniel Linares, 2016) Some types of probiotics include yogurt, cheese and pickles. (Judith Behnsen, 2013) A few types of unhealthy bacteria include Listeria, Norovirus, and Salmonella. (FoodSaftey.gov) These unhealthy bacteria cause pneumonia, tooth decay, tuberculosis, syphilis and diphtheria. (ByJu's.com) There are some things that stop bacteria. One main killer of bacteria is bacterial antibiotics. (Silvie Bernatová, 2013) Bacterial antibiotics kill the support of bacteria and the bacteria itself. (Silvie Bernatová, 2013) Surface Cleaners are also a great way to kill bacteria on all hard surfaces.

Surface Cleaner Facts

Surface Cleaners are pH neutral and are best used on hard surfaces. (Fila Solutions, 2021) Cleaners help with removing foul odors, dust and grime, along with stains and dirt. (LibreTexts, 2020) There are three types of surface cleaners; All-Purpose, Multi-Purpose and Special Purpose. All-Purpose cleaners are cleaners that you can basically spray on any hard surface you can think of, or whatever the bottle recommended to you. (LibreTexts, 2020) You can do this because they are gentle on hard surfaces. (Clean Cult, 2019) Meanwhile, Multi-Purpose cleaners are cleaners that can have multiple purposes or surfaces to clean but can't be used on everything like an All-Purpose cleaner. Multi-Purpose cleaners can also harm you and may cause irritation to your nose, skin, eyes, mouth and lungs. (Clean Living, 2020) Special Purpose cleaners are cleaners that are meant for cleaning a specific thing, such as a toilet bowl cleaner or maybe an oven

cleaner. It is a cleaner specifically made for a certain surface or job and has special chemicals that make the cleaner perform the special job it is supposed to. (LibreTexts, 2020)

All-Purpose cleaners are either slightly alkaline or neutral on the pH scale. They are safe and can be used on most hard surfaces and are also super effective on cleaning dirt off those surfaces. (LibreTexts, 2020) They are made up of water softeners and surfactants in concentrated amounts. The surfactants contain corrosion inhibitors, solvents, sometimes perfumes and even agents that keep your skin relatively safe. (LibreTexts, 2020)

Multi-Purpose cleaners can deal with grease and grime without you having to scrub too hard. They are mainly disinfectants, so you can clean the inside of your fridge, leave your counters clean enough to eat on, and can sanitize your food area. (Clean Cult, 2018) Multi Purpose cleaners last about two years in your cabinets. (Ayn-Monique Klahre, 2019)

The purpose of special purpose cleaners is to clean a specific surface. Special purpose cleaners are also referred to as dedicated cleaners. (UnifiedCleaning.com) They are made to dissolve oil and grease. (UnifiedCleaning.com) All special purpose cleaners have abrasives (Libretexts, 2020)

Hypothesis

If we use the Clorox surface cleaner then we will have the best results for this test. I know this because it says it kills 99.9% of viruses and **bacteria** right on the bottle. We believe that if it is made for killing bacteria, it most-likely will. Also, the Method surface cleaner we got is a plant-based cleaner, which we believe will harbor more bacteria than the other cleaners. This is because plant-based cleaners contain natural ingredients and bacteria is natural. This leads us to believe they will harbor more bacteria than the "bacteria killers" will.

Methods

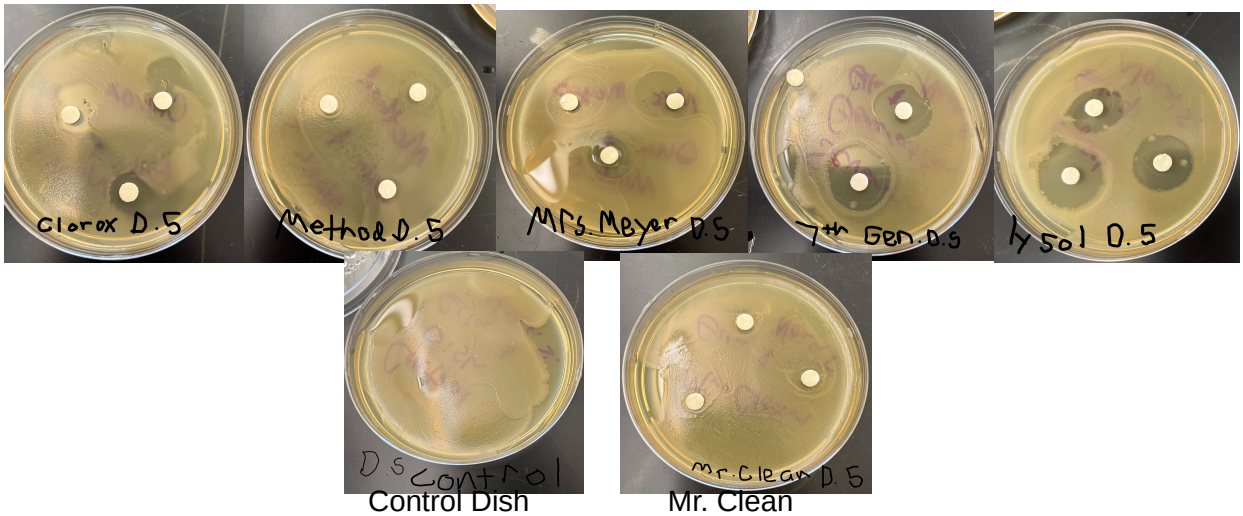
We experimented with bacteria and the surface cleaners that stopped, or stunted, their growth in our petri dishes. For this experiment, we first got the surface cleaners. We used Mr. Clean, Mrs. Meyer's Clean Day, Clorox, Lysol, Method and Seventh Generation. Then we proceeded to get seven petri dishes, distilled water, and nutrient agar. Next, we put the nutrient agar and the distilled water into each petri dish. Then, we streaked the agar with bacteria in the dish. We waited for our bacteria to grow for one week in an incubator. After that, we dropped three discs into a different surface cleaner on small cotton discs and placed them in all of the dishes in spaced out areas. Each cleaner was dropped into one petri dish, with three cotton discs holding the cleaner. Every five days, we observed the bacteria in each petri dish and measured each zone of inhibition. We did

this 3 times. We then put all of the data in a chart and studied the trends. Whichever surface cleaner repelled the least bacteria, shows us that the specific cleaner it was grown in is the least effective. Whichever surface cleaner repelled more bacteria, shows that the specific cleaner it was grown in is the best brand we've tested.

Results:

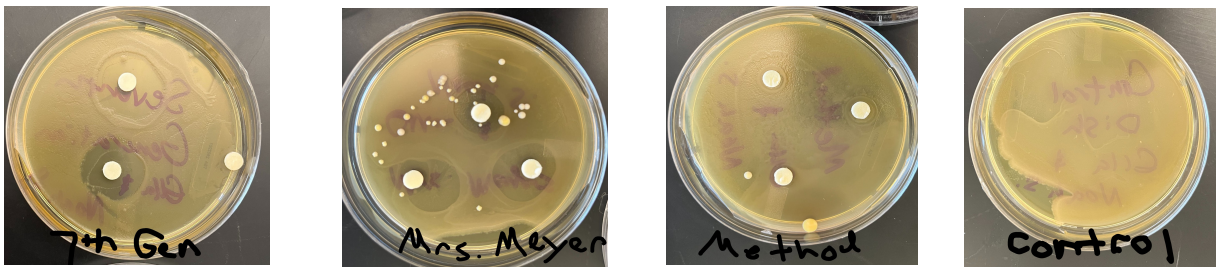
Day 5:

Clorox | Method | Mrs. Meyers | Seventh Generation | Lysol



Control Dish | Mr. Clean

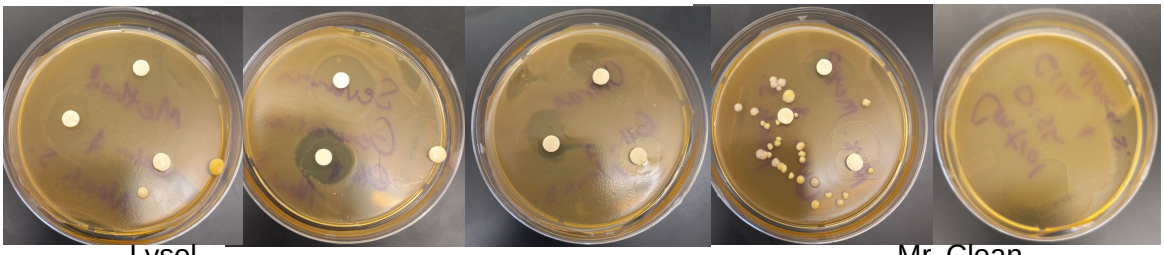
Day 11:



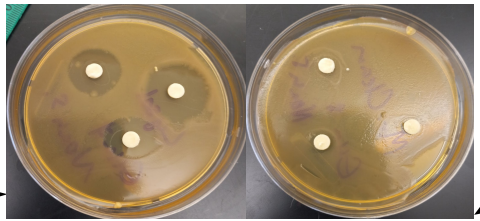
Day 15:

Seventh Generation | Mrs. Meyers | Method | Control

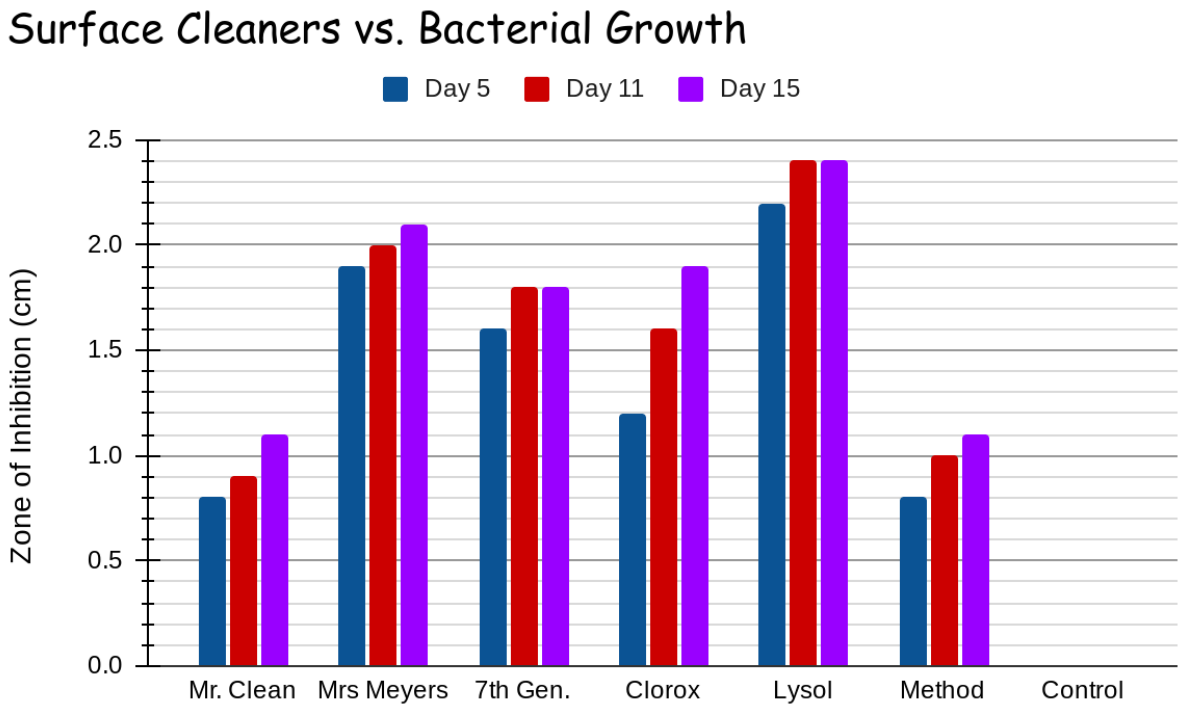
Method | Seventh Generation | Clorox | Mrs. Meyers | Control



Lysol | Mr. Clean



Days	Mr. Clean	Mrs Meyers	7th Gen.	Clorox	Lysol	Method	Control
Day 5	0.8 cm, 0.7 cm, 1.0 cm.	1.7 cm, 2 cm, 2.1 cm.	0 cm, 2.1 cm, 2.7 cm.	1.5 cm, 0.9 cm, 1.1 cm.	2.4 cm, 2.1 cm, 2.1 cm.	1.0 cm, 0.8 cm, 0.7 cm.	0 cm, 0 cm, 0 cm.
Day 11	1.1 cm, 0.9 cm, 0.8 cm.	2.3 cm, 1.8 cm, 2 cm.	0 cm, 2.8 cm, 2.5 cm.	1.5 cm, 1.9 cm, 1.5 cm.	2.9 cm, 2.1 cm, 2.1 cm.	1.0 cm, 0.8 cm, 1.2 cm.	0 cm, 0 cm, 0 cm.
Day 15	1.2 cm, 1.1 cm, 1.0 cm.	1.9 cm, 2.1cm, 2.4 cm.	0 cm, 2.9 cm, 2.6 cm.	2.0 cm, 1.6 cm, 2.1 cm.	2.6 cm, 2.1cm, 2.5 cm.	1.0 cm, 1.1 cm, 1.3 cm.	0 cm, 0 cm, 0 cm.



This graph shows that for the most part, day five was significantly lower than day fifteen. In some cases, like Seventh Generation and Method, it didn't have a large change. It went up subtly and, for Seventh Generation, didn't move at all at one point. As for the most change, I'd have to say that Clorox had the biggest change from Day 5 to Day 15. It also shows that Lysol was ahead of all the cleaners on Day 15 when it was only on Day 5. It was, by-far, the best cleaner.

Discussion:

The Lysol surface cleaner repelled the most and therefore was the best brand we've tested. Meanwhile, the Mr. Clean surface cleaner repelled the least bacteria, making it the least effective brand we've tested in our experiment. Also Mrs. Meyers, Method, and Mr. Clean surface cleaners have shown some signs of extra visible bacterial growth. These growths look like little white spheres. We got these results because the Lysol cleaner was the most powerful of the cleaners we've tested and it flew above and beyond all of the other cleaners. Seventh Generation would have also been a top competitor for the best repellant. Two discs in the Seventh Generation petri dish had a huge zone of inhibition, but the third disc was pressed up against the side. If that one disc wasn't an outlier, Seventh Generation might've taken the top spot for best average of the zone of inhibition.

Limitations:

We had many setbacks and problems when we were trying to set up our experiment and perform it. For instance, we were only planning on the bacteria growing in the test tube for one week, but we had to wait until we had the incubator to grow the bacteria any further. This took another five days. Also, we accidentally moved the Seventh Generation petri dish shortly after we had set it up. This caused one of the discs with the cleaner on it to be pressed up against the side of the dish. This made it so the zone of inhibition couldn't be measured for that one sterile disc. To add on, the incubator we decided to use had to remain at school at all times, and when the date rolled around to measure the zone of inhibition, we had to stay after school to measure it. This caused problems because on two of the dates we needed to stay after school to collect our data, we couldn't. One of the days (day 10) was on a Sunday, and because we don't have school on Sunday we couldn't get our data. We had to move the measuring date to

the Monday after that, which meant that it would be the bacterias 11th day of growing instead of the 10th. Similar problems occured on the following measuring date (day 15).

Future Studies:

Our next logical step would be to gather more cleaners and expand our experiment. We would expand it by getting more cleaners to test. We would then have a bigger sample and actually see which surface cleaner works the absolute best. We would also try this experiment on viruses and other illnesses. With viruses like Covid and the flu going around, we need to know which cleaners actually do the job they're made for.

References:

For Bacteria Facts & Knowledge

Kids.kiddle.co "Bacteria Facts For Kids" Last Updated: Jul. 5th, 2022

Vidyasagar, Aparna and Pappas, Stephanie. Live Science.com "What Are Bacteria?" Last Updated: Oct. 14th, 2021

Aryal, Sagar. Microbiology Info.com "Different Size, Shape and Arrangement of Bacterial Cells" Last Updated: Aug. 10th 2022

Nova Biologicals Team. NovaTx.com "10 Fast Facts About Bacteria" Last Updated: Nov 14th, 2021

Kadner, Robert. Britannica.com "Bacteria-Cell, Evolution & Classification" Last Updated: Oct. 6th, 2022

Genome.gov "Bacteria-Definition" Last Updated: Oct. 13th, 2022

Imb.au "What's the difference between bacteria and viruses?" Last Updated: Apr. 20th, 2020

NCBI.gov "Alkaline pH Homeostasis in Bacteria: New Insights" Last Updated: Sep. 26th, 2005

OUM.uk "Bacterial World–World Building Bacteria" From Oct. 19th, 2018–May 28th, 2019

Nature.com "Scientists bust myth that our bodies have more bacteria than human cells" Last Updated: Jan. 8th, 2016

Nouri, Aria. Aaas.org “The discovery of bacteria”

Daniel Linares, Paul Ross and Catherine Stantona. NCBI.gov “Beneficial Microbes: The pharmacy in the gut” Last Updated: Dec. 28th, 2015

For Surface Cleaner Facts & Knowledge

Chem.libretexts.org “All-Purpose and Special Purpose Cleaning Products” Last Updated: Aug. 10th, 2022

Blog.filasolutions.com “5 Key Facts About All-Purpose Cleaners for the Home” Last Updated: Aug. 1st, 2021

100percentpure.com “Read This Before Shopping for Multi-Surface Cleaners" Last Updated: Jul. 9th, 2020

Cleancult.com “When To Use All Purpose Cleaners” Last Updated: Jan. 22nd, 2019

Ayn-Monique Klahre “Here’s How Long Cleaning Supplies Actually Last” Last Updated: Sep. 4th, 2019

Unifiedcleaning.com “Multi-Purpose Cleaners Vs. Dedicated Cleaners”