



## COMPREHENSIVE OUTLINE OF METHODS FOR VEHICLE DISINFECTION



# CAR SANITATION

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## EXECUTIVE SUMMARY

passengers, who are often reluctant to board a non-sanitized vehicle. In light of the outbreak, there is a need for a quick and efficient method to sanitize vehicles with high passenger turnover. This to ensure both the wellbeing of passengers, as well as the long term prosperity of the auto industry.

The goal of this research is to provide a knowledgeable manual for car disinfection through presentation of different options and approaches. The research covers four main disinfection methods, provides information regarding common detergents against bacteria and viruses, best practices for cleaning a car from viruses and germs, as well as key suppliers for each method of cleaning and detergent.

The information in this research should be sufficient in supporting short term decisions for car sanitation, while giving a decent base to expand upon the topic of “human-less” (automatic) methods for car disinfections on a larger scale.



## BACTERIA VS. VIRUSES

Bacteria are single-celled microorganisms that thrive in many different types of environments, including extreme cold or heat. Viruses are substantially smaller than bacteria and depend on living hosts such as people, plants or animals in order to multiply; without a host a virus cannot survive. Once a virus enters the body, it invades select cells and takes over the cell machinery, reprogramming it to produce the virus.

Perhaps the most important distinction between bacterial and viral infections, is that antibiotic drugs are usually able to kill bacteria, but they are not effective against viruses. A car's interior may contain both bacteria and viruses, therefore, an adequate sanitation solution should be capable of eliminating both.

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## CLEANING VS. DISINFECTING

Cleaning refers primarily to the removal of visible dirt or particles; however, the cleaning process and some products used for cleaning also result in disinfection. Cleaning is normally undertaken on a routine and frequent basis.

Disinfection refers to specific measures taken to control, deactivate or kill infectious agents, such as viruses and bacteria. Disinfection is normally undertaken on an infrequent basis, during periodic maintenance checks or following a public health incident, such as the suspected carriage of an infectious passenger.

Possible routes of infection transmission that may occur onboard a vehicle fall into three categories:

- Directly inhaled respiratory droplets, suspended airborne particles, or both.
- Direct physical contact with fecal matter, blood or other bodily fluids.
- Contact with respiratory secretions, fecal matter or bodily fluids deposited on surfaces, or for maintenance crews, entrained in ventilation systems.

Sometimes, a case of communicable disease is known only several days (or longer) after the infected person has traveled and may have deposited pathogens on surfaces in the car. The risk of infection upon contact with such contaminated surfaces will depend on the viability of the organism, the number of organisms, whether the surface has been properly cleaned and/or disinfected, whether the pathogen is touched and transferred, as well as the susceptibility of the traveler.

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## SANITIZING METHODS

### CHEMICAL SANITATION

A proven way to eliminate bacteria and viruses is through the use of various chemical substances. Those chemical substances can be divided into four categories:

#### **Oxidizers**

The oxidation reaction happens when an oxidizer molecule collides with an oxidizable substance, such as algae, bacteria, sweat, urine, mold spores, and protozoa, which then causes the weakly bonded third oxygen atom to split off. During this reaction, organic molecules are destroyed, and dissolved metals become insoluble.

Chlorine: Chlorine is generally the disinfectant of choice as it is reasonably efficient, cheap and easy to handle. In all but the smallest water treatment plants, chlorine is added to water as either in aqueous solution (calcium hypochlorite or sodium hypochlorite) or chlorine gas. Smaller supplies may use tablets of hypochlorite.

#### **Aldehydes**

Aldehydes eliminate bacteria and viruses through alkylation, a proven aldehyde which is widely used in the industry is Glutaraldehyde.

Glutaraldehyde: Glutaraldehyde is a colorless liquid and has the sharp, pungent odor typical of all aldehydes, with an odor threshold of 0.04 parts per million (ppm). It is capable of sterilizing equipment, though to effect sterilization often requires many hours of exposure. Two percent solutions of glutaraldehyde exhibit very good activity against vegetative bacteria, spores and viruses. It is ten times more effective than formaldehyde and less toxic. However, it must be limited and controlled because of its toxic properties and hazards. It is important to avoid skin contact with glutaraldehyde as it has been documented to cause skin sensitization.

Glutaraldehyde is also an inhalation hazard. The NIOSH ceiling threshold limit value is 0.2 ppm.

#### **Alcohols**

Alcohol is often used to disinfect small surfaces (e.g. rubber stoppers of multiple-dose medication vials, and thermometers) and occasionally external surfaces of equipment (e.g. stethoscopes and ventilators). Since alcohol is flammable, limit its use as a surface disinfectant to small surface-areas and use it in well-ventilated spaces only. Prolonged and repeated use of alcohol as a disinfectant can also cause discoloration, swelling, hardening and cracking of rubber and certain plastics.

Ethanol: The bactericidal activity of various concentrations of ethyl alcohol (ethanol) was examined against a variety of microorganisms in exposure periods ranging from 10 seconds to 1 hour 483.

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*Pseudomonas aeruginosa* was killed in 10 seconds by all concentrations of ethanol from 30% to 100% (v/v), and *Serratia marcescens*, *E. coli* and *Salmonella typhosa* were killed in 10 seconds by all concentrations of ethanol from 40% to 100%. The gram-positive organisms *Staphylococcus aureus* and *Streptococcus pyogenes* were slightly more resistant, being killed in 10 seconds by ethyl alcohol concentrations of 60%–95%.

### **Cationic Surfactants**

Surfactants are substances that reduce the surface tension of a liquid or the interfacial tension of two phases. Cationic surfactants are surfactants that have a positively charged functional group.

Like any surfactant, cationic surfactants are composed of a polar and a non-polar part. The polar group is always a quaternary ammonium unit. The non-polar part consists of different alkyl rests.

In detergents, cationic surfactants provide disinfectant, biocidal properties. In water treatment, cationic surfactants are used as ion exchangers to obtain demineralized water. Cationic surfactants offer good corrosion protection and can be good demulsifiers. Cationic surfactants are used as drying aids in carwashes.

## **RADIATION**

### **UV Light**

Ultraviolet light is considered germicidal due to its ability to effectively eliminate bacteria.

UV radiation earns this classification by emitting a wavelength that falls between 200 and 300 nanometers. When light that exists in that spectrum is shined on bacteria, viruses, and other pathogens, it deactivates their DNA, destroying their ability to multiply and killing them.

Effectiveness of UV sanitation can vary based on a number of factors like length of exposure to bacteria, the intensity of the radiation, and a microorganism's resistance to said radiation.

The key to enhancing UV light sanitation in the face of these variables is delivering multiple passes of exposure. Hitting the subject you're hoping to sanitize multiple times will ensure bacteria with a little more resistance will also have their DNA deactivated.

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**Average cleaning time:** 20-30 minutes

**Exposure time:** To get 99% of viruses and bacteria: 2 meters from source - 30 minutes exposure, 40 cm from source - less than a minute. \*the efficiency increment is proportional to the square of the distance from the source.

**Disadvantages:** Devices, if not properly used, can damage skin or eyes. Dirty, greasy surfaces also reduce the ability of UVC to penetrate.

**Cost:** \$50-300 per device

**Involves human:** Yes

## OZONE

### Ozones Gas

Ozone has been documented to be significantly more effective than all the commonly-used sanitation chemicals available for commercial and industrial sanitation. It is unsurpassed for its antimicrobial efficacy, and is superior in terms of microbial log reduction. Also, given proper safety, material selection, and environmental controls, it demonstrates no negative impacts on the facilities, products or employees. Ozone treatment is a uniquely safe and sustainable non-thermal sanitation process and is compatible with the proper processing materials.

Direct product and surface application typically consists of a low-pressure spray using fixed spray bars, drench, shower or rain-type applicators (such as the Ozone Rain Pan), or with hand-held sprayers. It can also be added to flume water which can be recirculated if the process is moderately clean, or sent to the drain. When using gaseous ozone a new variable, humidity, will dramatically affect the results. The level of humidity in the environment will affect the ability of ozone to penetrate and destroy microorganisms.

\* Ozone Gas Generators are forbidden to use in California

\* Ozone Gas effectiveness against Covid-19 should be further researched

**Average cleaning time:** 20-120 minutes

**Exposure time:** The ozonation process utilizes a short contact time of approximately 10 to 30 minutes.

**Disadvantages:** When inhaled, ozone can damage the lungs.

Ozone gas has been proven to kill the SARS coronavirus and since the structure of the new 2019-nCoV coronavirus is almost identical to that of the SARS coronavirus, it is relatively safe to say that it will also work on the new coronavirus though it must be noted that there is no studies to date

**Cost:** \$50-500 per device

**Involves human:** Yes

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## Ozone Water

Ozone water is water with a certain concentration of oxygen gas which has undergone a process that has made it ozone. The combination of the two creates an antioxidant with antiseptic ability.

Ozone Water is effective because typically, viruses are small, independent particles, built of crystals and macromolecules. Unlike bacteria, they multiply only within the host cell. Ozone destroys viruses by diffusing through the protein coat into the nucleic acid core, resulting in damage of the viral RNA. At higher concentrations, ozone destroys the capsid or exterior protein shell by oxidation. Once the lipid envelope of the virus is fragmented, its DNA or RNA core cannot survive. Ozone is known to interact with proteins, carbohydrates, and nucleic acids, viruses have no protections against this oxidative stress.

According to results of the experiment on how ozone kills SARS virus, ozone is effective in killing the SARS virus on cells, realizing a killing rate of 99.22%. Due to Coronavirus being an enveloped virus, which is similar to the SARS in 80%, the estimation is that the ozone will have the same effect on it.

**Average cleaning time:** 60-90 minutes

**Exposure time:** 10-30 minutes

**Disadvantages:** Whether ozone can take effect depends heavily on our ability to control its concentration level. The volatile gas is easy to produce, but difficult to be controlled at a specific level, because of the cost of ozone sensors. Without the real-time test of sensors, it is difficult to control its concentration and thus assure its effectiveness.

**Cost:** Machinery ~300\$, \$30 per cartridge refill

**Involves human:** Yes

## HEAT

### Heating

High temperature brakes the outer layer of the virus, the efficiency of the process increases as the temperature applied increases.

**Average cleaning time:** 6-7 minutes

**Exposure time:** 5 minutes at a temperature of above 60C

**Disadvantages:** Can damage interior

**Cost:** 1000-3500\$ for a device

**Involves human:** Yes

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## Steaming

Heat disinfection, otherwise known as thermal disinfection, relies on moist heat to kill bacteria and viruses by exposure to a specific temperature for a specific amount of time. High temperatures can destroy proteins in viruses and bacteria, rendering them as dead or inert. This sterilization technique does not involve any toxic liquids or fumes, and is relatively inexpensive, quick and effective in killing and eliminating potentially infectious bacteria, viruses and spores. Bacteria and viruses are made up of proteins, and moist heat sterilization works by denaturing these proteins. Denaturation is a process in which the structures of the proteins are disrupted and altered, and once the bacteria and viruses are denatured, they are unable to cause infection. While moist heat sterilizers are used in many other applications such as hospitals and cooking equipment, there are very little handheld solutions on the market.

**Average cleaning time:** 15-30 min

**Exposure time:** Medium

**Disadvantages:** Expensive machinery. Covers small surface area

**Cost:** 1000-3000\$ per device

**Involves human:** Yes

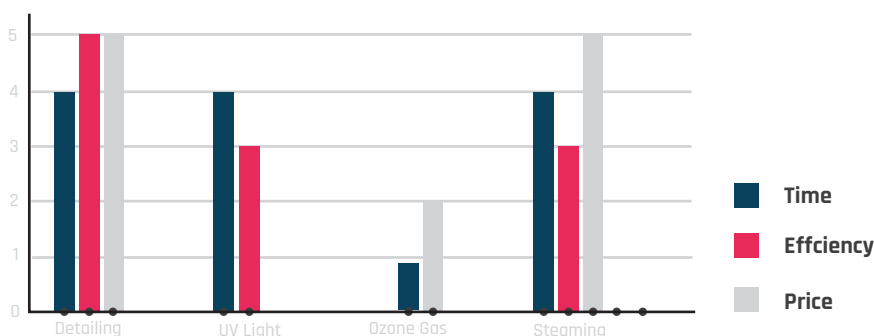
## Method Comparison

Below is a comparison of the methods based on 3 categories:

Time - 1 is the longest and 5 is the shortest

Efficiency - 1 is the least effective and 5 is the most effective

Price - 1 is the most expensive and 5 is the most affordable





## SANITIZING MATERIALS

### OZONE WATER

Ozone water sanitation is one of nature's most powerful sanitizers.

During sanitation with ozone, a two-step process is generally required. Surfaces are cleaned and biofilms are removed with hot water or cleaning steps. Then, aqueous ozone is used to sanitize the surface destroying all bacteria, viruses, fungi, and spores. No other sanitation step after the use of ozone is necessary. In fact, no-rinse step is necessary after ozone as the ozone will leave no residue on the surface. This may lower the cleaning time and water usage costs. There are some disadvantages to ozone disinfection. Ozone has been shown to produce small amounts of bromate which is a suspected carcinogen. More importantly, like ultraviolet water purification, ozone disinfection provides no residuals in the distribution system to suppress regrowth. Thus, if any harmful microorganisms survive the initial O<sub>3</sub> disinfection, there is a risk that there might be regrowth in post disinfected surfaces. To guarantee public safety Ozone disinfection should be augmented with some level of disinfectants, like chloramines, that can provide a persistent residual.

**Cost:** A machine must be purchased in order to produce the Ozone Water. The cost of this type of machine ranges from \$ 100 to several thousands.

**Method of use:** The ozone must be injected into water through a machine, and then the mixture can be used as a disinfectant in the shape of liquid.

**Disadvantage:** Low dosages may not effectively inactivate some viruses, spores, and cysts. Ozonation is more complex than other disinfection technologies. Ozone is very reactive and corrosive, thus requiring corrosion-resistant material, such as stainless steel. Ozone is extremely possibly toxic, so off-gases from the contactor must be destroyed to prevent worker exposure.

**Efficiency level:** Amid the impacts of the coronavirus and COVID-19, which is in the group of airborne viruses, most of them tend to stick to surfaces such as door handles or even utensils.

**Manufacturers:**

- Shenzhen Guanglei Electronic Co. Ltd.
  - Huron
  - MoldCont
  - Ozonlife
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## ACCELERATED HYDROGEN PEROXIDE (0.5%)

Composed of Hydrogen Peroxide, Surface Acting Agents (surfactants), wetting agents (a substance that reduces the surface tension of a liquid, causing the liquid to spread across or penetrate more easily the surface of a solid) & chelating agents (a substance that helps to reduce metal content and/or hardness of water). The ingredients are all listed on the EPA and Health Canada Inerts lists and the FDA Generally Regarded as Safe List (GRAS). All chemicals used in the formulation of AHP® are commonly found in commercial and industrial cleaners and disinfectants. In a recently published study, AHP® was included among the disinfectants that have been shown to have proven efficacy against various strains of Coronavirus. In fact, the AHP® technology carries efficacy claims against five different strains of Coronavirus including MERS-CoV.

**Cost:** 70\$ \ Gallon

Method of use: Most commonly used as a disinfectant in the shape of liquid.

**Disadvantage:** Hydrogen peroxide is a strong oxidizer (moderate oxidizer in lower concentrations) and can be corrosive to the eyes, skin, and respiratory system. This chemical can cause burns to the skin and tissue damage to the eyes.

**Advantage:** The product is ready to use as is. One of the most efficient detergents.

**Efficiency level:** research shows that when using Hydrogen peroxide there is rapid contact time (under 1 minute) with the ability to destroy enveloped viruses and vegetative bacteria, including superbugs. Effectiveness at cleaning and removing Clostridium difficile spores off surfaces. Safe to use on all hard surfaces and fabrics.

**Manufacturers:**

- Scican - OPTIM1
- Virox Technologies Inc



## BENZALKONIUM CHLORIDE (0.5%)

It is a quaternary ammonium compound that acts as an antimicrobial agent by denaturing proteins and disrupting cytoplasmic membranes. It is primarily used as a preservative and antimicrobial agent, and secondarily used as a surfactant. It works by killing microorganisms and inhibiting their future growth. commonly used as a surfactant and antibacterial agent, and is commonly found in household cleaning products. Effects of short-term exposure, Benzethonium chloride is corrosive to the eyes and is irritating to the skin. Long-term effects of repeated exposure may cause dermatitis.

**Cost:** 75\$/GALLON.

**Method of use:** Most commonly used as an active ingredient in cleaning wipes. It can also be used as disinfectant spray.

**Disadvantage:** Concentrated solutions are toxic to humans, causing corrosion/irritation to the skin and mucosa, if taken internally in sufficient volumes. It can also cause an allergic reaction, like rash; hives; itching; red, swollen, blistered, or peeling skin with or without fever.

**Efficiency level:** Medium efficiency level.

**Manufacturers:**

- Richest Group
- Lab Alley

## CHLOROXYLENOL (0.12%)

The antimicrobial activity of chloroxylenol is apparently attributable to the inactivation of bacterial enzymes and alteration of cell walls. It has good in vitro activity against Gram-positive organisms and fair activity against Gram-negative bacteria, mycobacteria, and some viruses. Chloroxylenol is active against a wide range of viruses and bacteria and including coronaviruses. Its use is as a surface disinfectant on hard surfaces or on skin and wounds. It can also be incorporated into soaps. Chloroxylenol is poisonous if ingested and it should not be used as an aerosol that people may breathe. The antiviral action of chloroxylenol was assessed against a range of enveloped and nonenveloped human viruses using a suspension test method.

**Cost:** 35\$/Gallon

**Method of use:** Most commonly used as disinfection in the shape of tincture.

**Disadvantage:** Toxicity varies with a specific compound. It can be absorbed through the skin and Latex gloves. Some formulations may have an unpleasant odor. Corrosive. Skin irritant. Not effective against spores and some viruses. Prolonged contact deteriorates rubber.

**Advantages:** Ready to use as is.

**Efficiency level:** High

**Manufacturer:** Dettol

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## ETHYL ALCOHOL (70%)

Ethyl alcohol, at concentrations of 60%–80%, is a potent virucidal agent inactivating all of the lipophilic viruses (e.g., herpes, vaccinia, and influenza virus) and many hydrophilic viruses (e.g., adenovirus, enterovirus, rhinovirus, and rotaviruses). It requires water to work – the water will open bacterial pores, allowing alcohol to infiltrate the bacterial cells and kill them. In terms of the topical coronavirus, the CDC does state that alcohol solutions with at least 70% alcohol should be effective when it comes to the disinfection of the virus. Ethyl alcohol (70%) is a powerful broad-spectrum germicide and is considered generally superior to isopropyl alcohol.

**Cost:** 30-40\$ / Gallon

**Method of use:** It is used as a solvent, in the synthesis of other organic chemicals.

**Disadvantage:** People who are exposed to ethanol, by skin contact and/or inhalation, at low concentrations, have increased health risks (reproductive toxicity, neurotoxicity, etc.).

**Efficiency level:** High. The efficacy of 70% ethanol evaluated for the treatment of SARS-CoV reduced the virus infectivity to below the detectable level.

**Advantage:** Ready to use as it is.

**Manufacturers:**

- Gizmo Sanitizer
- Reagents
- Lab Alley



## IODINE IN IODOPHOR (50 PPM)

An Iodophor is a preparation containing iodine complexed with a solubilizing agent, such as a surfactant or povidone (forming povidone-iodine). The result is a water-soluble material that releases free iodine when in solution. Iodophors are prepared by mixing iodine with the solubilizing agent; heat can be used to speed up the reaction.

Iodophors - combinations of iodine with surface-active agents such as nonionic detergents - are non-staining and non-irritant, and are effective as antiseptics and as surface disinfectants. They have a broad spectrum of antimicrobial activity, including activity against acid-fast bacteria and hydrophilic viruses. Iodophors must be properly diluted to have the desired effects. Iodophors have been useful for the disinfection of instruments.

**Cost:** 150\$ / Gallon

**Method of use:** Most commonly used as a liquid tincture. can be used also as a tincture, ointment or gel.

**Disadvantage:** expensive compared to other materials. The significant contact or residence time required for an effective microbial kill is long (up to 30 minutes). In addition, iodine sanitizers have an odor that some people find unacceptable, and iodine solutions can stain, leaving equipment surfaces yellow or orange. Iodine poisoning can cause: burning of the mouth, throat, and stomach.

**Efficiency level:** Medium. The efficacy of several povidone-iodine products, a number of other chemical agents and various physical conditions were evaluated for their ability to inactivate the severe acute respiratory syndrome coronavirus (SARS-CoV). Treatment of SARS-CoV with the products for 2 min reduced the virus infectivity to below the detectable level.

**Manufacturers:**

- Delaval
- Choice Organochem
- Kaustubha Bio Products



## MATERIALS COMPARISON

	COST	METHOD OF USE	DISADVANTAGE	MANUFACTURERS	EFFICIENCY LEVEL
<b>ACCELERATED HYDROGEN PEROXIDE (0.5%)</b>	70\$ \ Gallon	Liquid. Ready to use.	Hydrogen peroxide is a strong oxidizer (moderate oxidizer in lower concentrations) and can be corrosive to the eyes, skin, and respiratory system. This chemical can cause burns to the skin and tissue damage to the eyes.	Scican - Virox	High, 1 minutes exposure time
<b>BENZALKONIUM CHLORIDE (0.5%)</b>	75\$ \ Gallon	cleaning wipes/ spray	Concentrated solutions are toxic to humans, causing corrosion/irritation to the skin and mucosa, if taken internally in sufficient volumes. It can also cause an allergic reaction, like rash; hives; itching; red, swollen, blistered, or peeling skin with or without fever.	Richest Group Lab Alley	Medium, ~ 2 minutes exposure time.
<b>CHLOROXYLENOL (0.12%)</b>	35\$ \ Gallon	Most commonly used as disinfection in the shape of tincture.	Toxicity varies with a specific compound. It can be absorbed through the skin and Latex gloves. Some formulations may have an unpleasant odor. Corrosive. Skin irritant. Not effective against spores and some viruses. Prolonged contact deteriorates rubber.	Dettol	High, 1 minutes exposure time
<b>CHLOROXYLENOL (0.12%)</b>	150\$ / Gallon	Most commonly used as a liquid tincture, can be used also as a tincture, ointment or gel.	Expensive compared to other materials. The significant contact time required for an effective microbial kill is long (up to 30 minutes). Iodine sanitizers have a strong odor, and iodine solutions can stain equipment surfaces. can also cause iodine poisoning.	Gizmo Sanitizer Reagents Lab Alley	The efficacy of 70% ethanol evaluated for the treatment of SARS-CoV reduced the virus infectivity to below the detectable level.
<b>OZONE WATER</b>	A machine must be purchased which produces the Ozone Water. The cost of this type of machine ranges from \$ 100 to several thousands.	The ozone must be injected into water through a machine, and then the mixture can be used as a disinfectant in the shape of liquid.	Low dosages may not effectively inactivate some viruses, spores, and cysts. Ozonation is more complex than other disinfection technologies. Ozone is very reactive and corrosive, thus requiring corrosion-resistant material, such as stainless steel. Ozone is extremely possibly toxic, so off-gases from the contactor must be destroyed to prevent worker exposure.	Shenzen Guanglei Electronic Co. Ltd. Huron MoldCont Ozonlife	Amid the impacts of the coronavirus and COVID-19, which is in the group of airborne viruses, most of them tend to stick to surfaces such as door handles or even utensils..



## INSTRUCTIONS OF DISINFECTION (CDC INSTRUCTIONS)

### **HARD (NON-POROUS) SURFACES**

Wear disposable gloves when cleaning and disinfecting surfaces. Gloves should be discarded after each cleaning. If reusable gloves are used, those gloves should be dedicated for cleaning and disinfection of surfaces for COVID-19 and should not be used for other purposes. Consult the manufacturer's instructions for cleaning and disinfection products used. Clean hands immediately after gloves are removed.

If surfaces are dirty, they should be cleaned using a detergent or soap and water prior to disinfection.

For disinfection, most common EPA-registered household disinfectants should be effective. A list of products that are EPA-approved for use against the virus that causes COVID-19 is available [here](#).

Follow manufacturer's instructions for all cleaning and disinfection products for (concentration, application method and contact time, etc.).

Additionally, diluted household bleach solutions (at least 1000ppm sodium hypochlorite) can be used if appropriate for the surface. Follow manufacturer's instructions for application, ensuring a contact time of at least 1 minute, and allowing proper ventilation during and after application. Check to ensure the product is not past its expiration date. Never mix household bleach with ammonia or any other cleanser. Unexpired household bleach will be effective against coronaviruses when properly diluted.

Prepare a bleach solution by mixing:

5 tablespoons (1/3rd cup) bleach per gallon of water or

4 teaspoons bleach per quart of water

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## **SOFT (POROUS) SURFACES**

For soft (porous) surfaces such as car carpets and drapes, remove visible contamination if present and clean with appropriate cleaners indicated for use on these surfaces. After cleaning:

Launder items as appropriate in accordance with the manufacturer's instructions. If possible, launder items using the warmest appropriate water setting for the items and dry items completely.

Otherwise, use products that are EPA-approved for use against the virus that causes COVID-19 and that are suitable for porous surfaces.

### **Electronics**

For electronics such as Consoles, tablets, touch screens, and remote controls remove visible contamination if present.

Follow the manufacturer's instructions for all cleaning and disinfection products.

Consider the use of wipeable covers for electronics.

If no manufacturer guidance is available, consider the use of alcohol-based wipes or sprays containing at least 70% alcohol to disinfect touch screens. Dry surfaces thoroughly to avoid the pooling of liquids.

## **GENERAL CAR INTERIOR CLEANING**

The first step to cleaning and disinfecting a car's interior is to choose the cleaning agents and materials you will use. Depending on whether the car has leather, cloth, or imitation leather upholstery, steps, and cleaning agents will differ.

Isopropyl alcohol is a proven disinfectant and is also safe to use on most car interior surfaces. In fact, it is used in many production plants to put a final touch on interior components before they are shipped out. Isopropyl alcohol will remove many stains, smudges, and residues, as well as kill bacteria and viruses. However, that stain removing quality can also cause problems with leather.

If a vehicle has a leather interior, it probably has a thin protective coating to prevent discoloration. Isopropyl alcohol can deteriorate that coating and even remove the dye from the leather itself.

For leather steering wheels, seating, and trim, a combination of soap and water is a safe and sufficient way to clean them. There is no need to scrub hard when cleaning a leather interior, and one should avoid excess suds and water.

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## RELATED COMPANIES / STARTUPS (CATEGORIZED BY SANITATION METHOD)

### UV LIGHT

#### **CleanSlate UV**

CleanSlate UV allows staff, patients and visitors to sanitize their personal items (such as phones, tablets and badges) while they wash or sanitize their hands. This helps improve hand hygiene and reduce the risk of hospital acquired infections.

<https://cleanslateuv.com/>

#### **Infection Prevention Technologies**

Infection Prevention Technologies is an industry leader in the design and manufacturing of UV-C Robots used in the disinfection of health care facilities.

With the most powerful UV robot in the world, IPT offers the next generation in UV light disinfection. Our patented and patent-pending technology for whole-room treatment, a power boost that pushes our units beyond the UV disinfection capabilities of our competitors, and automated dosing give IPT healthcare customers the most sophisticated and effective solutions to prevent Healthcare Associated Infections (HAIs).

#### **EverGreen UV**

<http://www.lumalier.com/>

Lumalier is the recognized leader in advanced UV Germicidal Air Disinfection products designed to benefit the Healthcare, Educational, Institutional, Commercial, Office and Residential markets. Lumalier is the industry benchmark for safe, healthy air disinfection and has been for over 47 years.

UVGI is a proven technology that has been employed by hospitals and government agencies for more than 75 years. Recent improvements in the technology have made it affordable and available to everyone.

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## CLEANING MATERIALS

### Clorox

The Clorox Company (formerly Clorox Chemical Co.), based in Oakland, California, is an American global manufacturer and marketer of consumer and professional products. The Clorox Company currently owns a number of well-known household and professional brands across a wide variety of products.

<https://www.clorox.com/>

### Thymox Technology

Bactericidal, Fungicidal and Virucidal disinfectant cleaner for different markets and uses more.

Cleaning firms have the responsibility to maintain and clean a wide range of different establishments such as government buildings or industrial environments on a daily basis. Currently the requirement is for an environmentally friendly product that ensures the safety of the employees. Thymox is safer than bleach, ammonia, and conventional disinfectants. Thymox is less corrosive, less toxic, less of a respiratory irritant, and environmentally friendly. Thymox is the healthier disinfectant and cleaning alternative.

<https://www.crunchbase.com/organization/thymox-technology#section-overview>

<https://thymox.com/>

## GORILLA WIPES BY WET WIPES

Gorilla Wipes are ideal for surface cleaning and caring, useful for wiping your car inside and outside.

Gorilla wet wipe is a professional choice for your car care.

It helps to keep the original condition of the car.

By choosing the appropriate product you can clean your car inside and outside in one step.

Simple and fast, provides prompt results, and does not need additional wiping.

Practical and space-saving packaging format, comfortably fits to any glove box or in the side-door.

- unique shape, easy-to-close dispenser top
- elegant design
- especial, enduring wipe material
- delicate fragrances
- you can clean even 200% bigger surface with a single sheet compared with other brands

<https://www.gorillawipes.com/en/>

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## **PSA**

pure product of the French know-how, offers a complete range of solutions, specifically developed and adapted for an aeronautical use:

- Aircraft Insecticides
- Disinfectants and cleaners
- Cabin fragrances, odour treatments
- Protection of flight crew
- Cleaning machines

A European company that designs and produces innovative solutions for hygiene, disinfection and protection of aircrew for the aviation industry. We are now part of the Callington Group of Companies. Thanks to more than 40 years of experience, we have established ourselves as a solutions provider in aircraft hygiene worldwide. Every day, 160 airlines operate tens of thousands of flights that have decided to trust us.

<https://www.psa-paris.com/our-company/>

## **STEAM**

SJE Corporation Ltd., has produced industrial steam cleaners in Korea which are famous as “Optima Steamer” in the world. With its advanced technology and after-sales service system worldwide, it has provided its machines to more than 120 countries.

<https://www.sjecorp.com/>

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