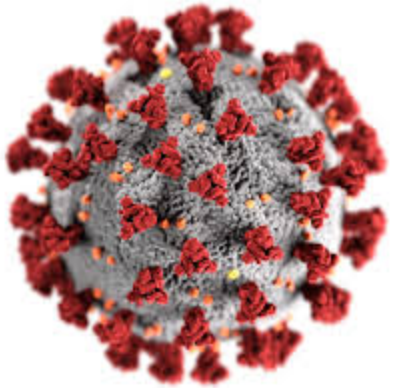
Disinfecting Scuba Equipment

The future of equipment cleaning in the wake of COVID-19

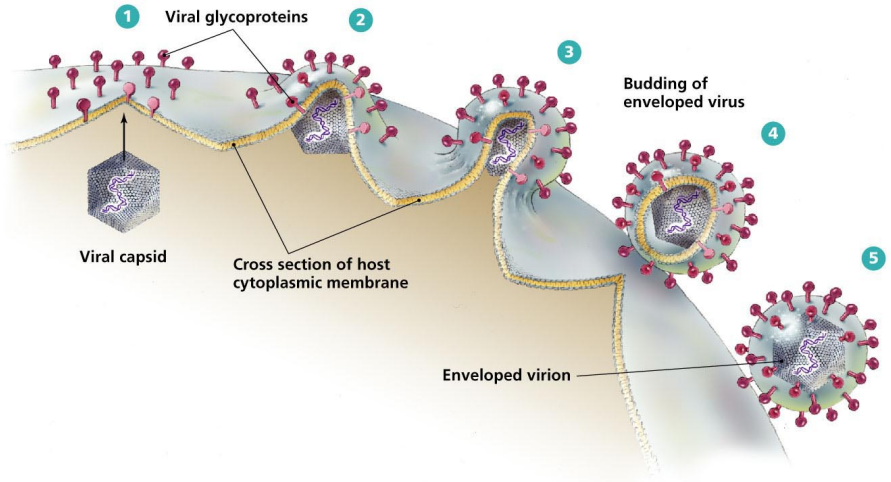
What exactly is COVID-19?

- COVID-19, or SARS-CoV-2
- Coronavirus
- Enveloped
- Spreads by droplets: coughing, sneezing, etc.



Enveloped virus

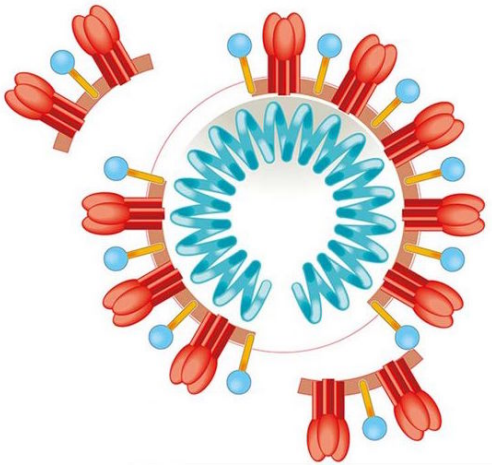
- Fatty envelope that surrounds a virus
- Protects the virus when outside the host cell
- Easily damaged



http://academic.pgcc.edu/~kroberts/Lecture/Chapter%2013/animalrep.html?fbclid=IwAR1i1iblwUR02bWqjqvfKwu6FpqYZmKtdwPFSFcTQPIXa-7ijZCk4hL53zI

Why is the viral envelope important?

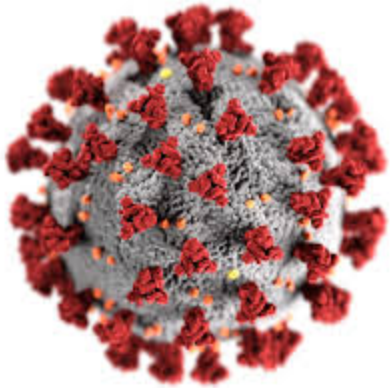
- Damaging the envelope will damage the virus
- The virus cannot infect anymore and it will die
- Viral envelopes can also dry out and fail to protect the viral contents.



https://gulfnews.com/lifestyle/health-fitness/covid-19-how-soap-annihilates-a-virus-1.1585140805837?slide=8

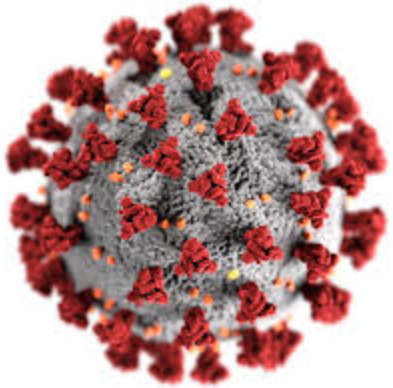
SARS-CoV-2 survival times

- COVID-19
  - 2-3 days on plastic and steel
  - Up to 4 hours on copper
  - Up to 3 hours in aerosol
  - Up to 24 hours on cardboard



Similar virus survival times

- Human coronavirus 229E
  - 2-6 days on plastic
  - 5 days on steel glass, PVC, silicone, Teflon™ and ceramic
  - 8 hours on latex
  - 2-8 hours on aluminum
- SARS virus (SARS-CoV-1)
  - Up to 9 days on plastic
  - 5 days on metal
  - 4-5 days on paper
  - 4 days on wood and glass



Will the virus survive on fabric?

- No data on SARS-CoV-2 survival on fabrics
- Very little data on enveloped viruses surviving on fabric
- One other enveloped virus survived for one day on denim
- Experts believe survival time depends on porosity of fabric
- Porous fibers may damage virus particles more easily.
- Viruses may survive for shorter times on natural fibers and longer on synthetics

DAN

The importance of disinfection

- COVID-19 survival times inconsistent
- Quicker turn around for rental equipment
- Reduced risk of transmission of COVID-19 between divers

https://www.diversalertnetwork.org/emailView/landing/blogs/cleanEquipment19/index.html

What to disinfect

- Equipment that comes into contact with eyes/face/mouth
  - Mask
  - Snorkel
  - Regulator
  - BCD oral inflator
- Equipment shared between divers
  - Rental equipment
- Equipment that is high-touch
  - Cylinders
  - Fill station

https://www.diversalertnetwork.org/news/dan-encourages-divers-and-dive-operators-to-properly-disinfect-dive-gear

Types and methods of disinfection

- Heat
- Soap and water
- Bleach
- Quaternary ammonium compounds
- Alcohol

https://www.cdc.gov/coronavirus/2019-ncov/community/disinfecting-building-facility.html

Types and methods of disinfection: Heat

- Can I use hot water to disinfect regulators?
  - Theoretically yes
  - However, soaking time and temperature are high
  - Could cause damage to equipment
  - Disinfectant solution is better
- Can SARS-CoV-2 enter a compressor?
  - Yes, the virus is as small as 0.5 microns, compressor filters catch 5 microns
  - Data shows SARS-CoV-2 can be killed after 15-30 minutes at 133°F (56°C)
  - A compressor heats the gas to around 150°F (65°C) during each stage
  - Peak temperatures reach 400 – 900°F (200-480°C).

DAN

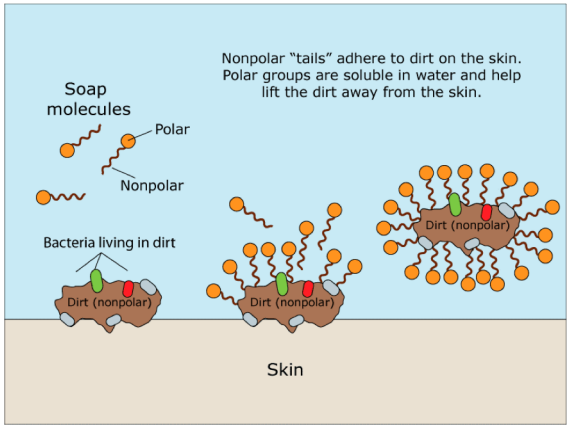
Can SARS-CoV-2 enter a cylinder?

- Theoretically yes
- Is cylinder valve or fill whip are contaminated
- Same concept for assembly of regulator

http://www.alertdiver.com/551

Types and methods of disinfection: Soap and Water

- Soap and water make micelles
  - Water-loving head and water-fearing tail
  - Bond to the fatty viral envelope
- Must be combined with mechanical action
- Soaking equipment in soapy water will not be enough to reliably remove viruses



https://www.defeatdd.org/blog/how-does-soap-actually-work

Types and methods of disinfection: Bleach

- Destroys proteins in the virus, including the viral genome
- The CDC recommends 1/3 cup in 1 gallon water (4:100) with a soaking time of one minute
- Do not use hot water, this will decompose the active ingredient
- Never mix with other chemicals
- Mix fresh solutions in well-ventilated areas with proper PPE
- Rinse disinfected equipment thoroughly and allow to dry completely

Types and methods of disinfection: Quaternary ammonium compounds

- Hydrophobic compounds that attack the viral envelope and "disorganize" it
- Very common in cleaning solutions
- Harmful to aquatic environment- take care when disposing

https://www.vectorstock.com/royalty-free-vector/cleaning-supplies-kitchen-sponges-and-cleaning-vector-20635211

Types and methods of disinfection: Alcohol

- Destroys proteins and viral genome
- CDC: 60% alcohol for hands, 70% alcohol for surfaces
- Contact time varies, 30 seconds to 1 minute.
- Alcohol can degrade soft parts of equipment such as o-rings.
- Alcohol is a fire hazard when used near fill stations or heat sources.

Choosing a disinfectant

- Use a disinfectant on the EPA's "List N"
  - These have been proven to kill SARS-CoV-2
  - Always follow the directions for mixing and soaking time
  - Rinse thoroughly and allow to dry before using
- If unavailable, use CDC's bleach recipe

Is my chosen disinfectant safe to use on scuba equipment?

- The American Chemistry Council Center for Biocide Chemistries
  - Has a PDF of List N sorted by brand name.
  - The EPA's List N is sorted by "basic product"
- Search for the EPA registration number for your selected product
- Find the EPA registration
- Find list of uses
  - Should specify dive equipment, respirators, or specific materials

DAN

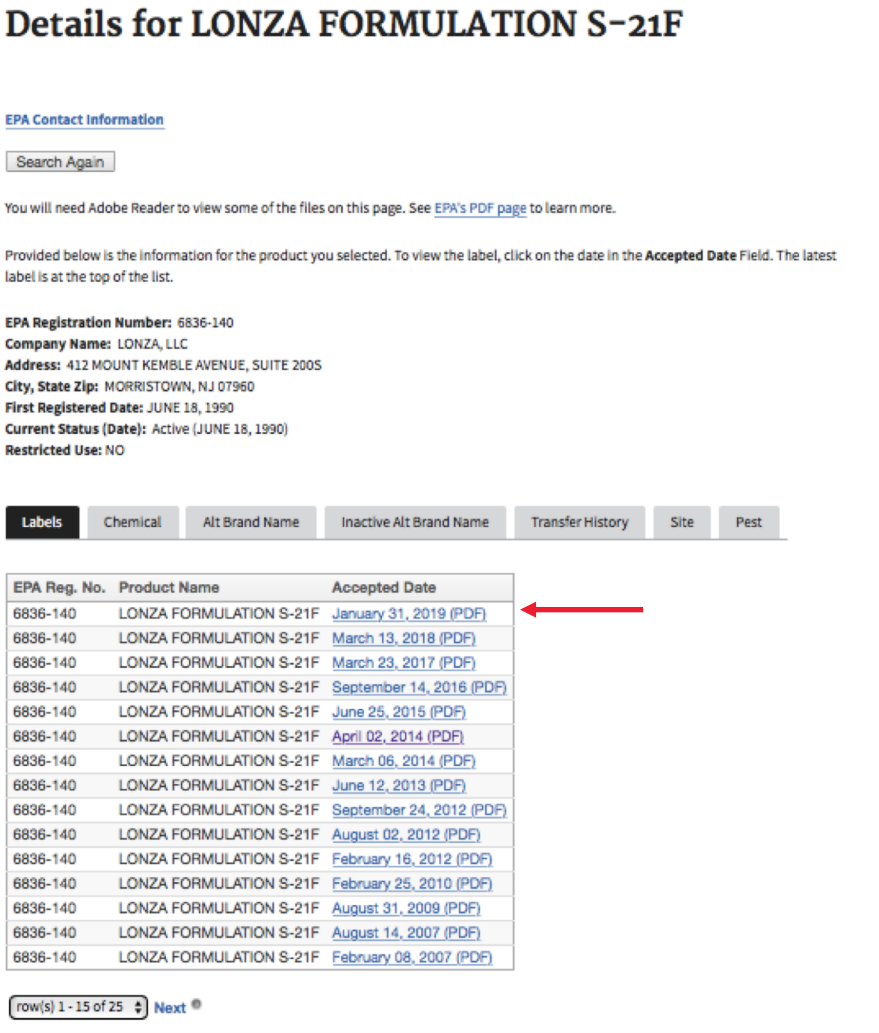
Example: Simple Green d Pro 5
EPA reg. no. 6836 -140 - 56782

Tier I Products - Products that are in compliance with EPA's *Emerging Viral Pathogen Guidance for Antimicrobial Pesticides*		
Ready to Use Products		
Commercially Available Product Name	**Company/Distributor**	**EPA REG No.**
Sanifect Plus 1	U S Chemical	47371-131-7546
Sanifect Plus 2 Fresh N Clean	U S Chemical	47371-131-7546
SANITIZER / COMMERCIAL SANITIZER	Ecolab Inc	6836-302-1677
Sanix	UNX Industries, Inc.	47371-130-7116
SD Disinfecting Cleaner	Native Green	6836-77-85898
Simo-Tab Disinfectant Tablets	Simoniz USA, Inc.	71847-6-18305
Simple Green d Pro 5	Sunshine Makers, Inc.	6836-140-56782
Stepan Spray Disinfectant Concentrate	Stepan Company	1839-248
SUPER 60 PYM 64 FOAMER	Pioneer Chemical Co.	47371-131-151
SUPER SAN FOOD SERVICE SANITIZER	Ecolab Inc/Kay Chemical Co.	6836-305-1677
Symplicity Sanibet Multi-Range Sanitizer	Betco Corporation	6836-266-4170
Synergex	Ecolab Inc	1677-250

DAN

Screenshot of the The American Chemistry Council Center for Biocide Chemistries list of Novel Coronavirus (COVID-19) Fighting Products

Screenshot of the The results of searching Simple Green d Pro 5 in the EPA search for registered pesticide products



Details for LONZA FORMULATION S-21F

EPA Contact Information

Search Again

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

Provided below is the information for the product you selected. To view the label, click on the date in the **Accepted Date** Field. The latest label is at the top of the list.

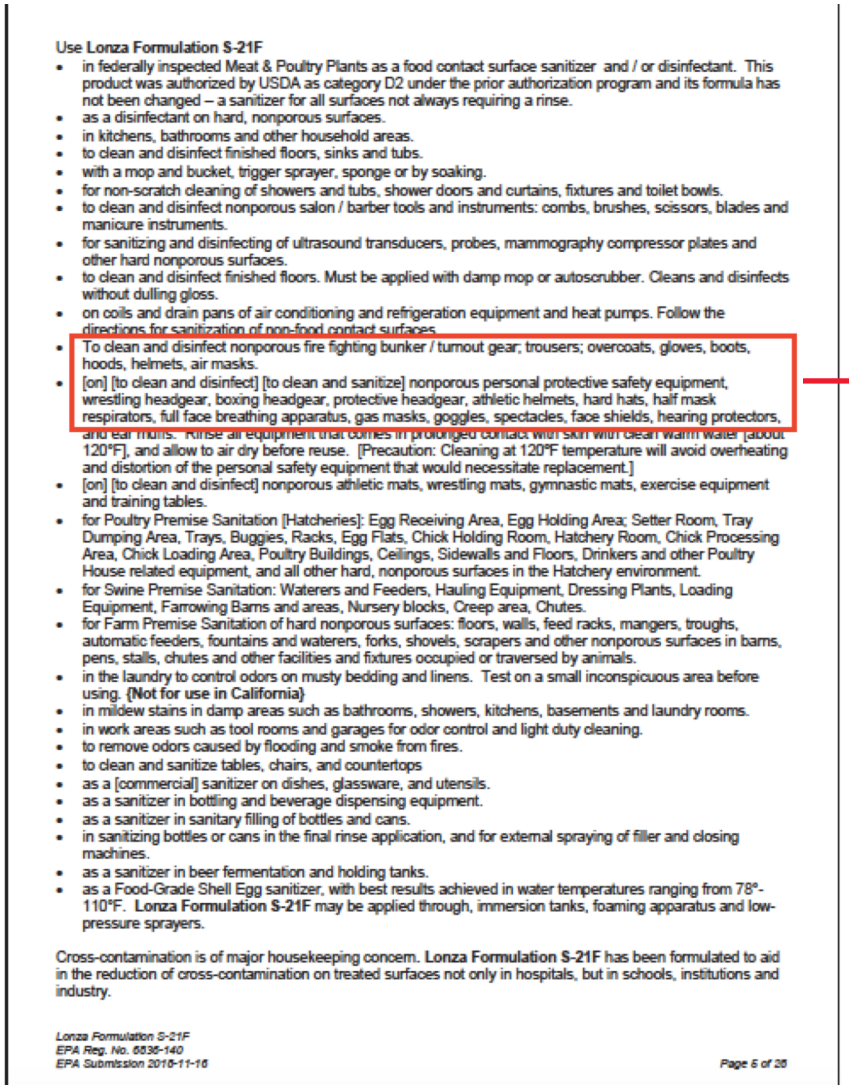
EPA Registration Number: 6836-140
Company Name: LONZA, LLC
Address: 412 MOUNT KEMBLE AVENUE, SUITE 200S
City, State Zip: MORRISTOWN, NJ 07960
First Registered Date: JUNE 18, 1990
Current Status (Date): Active (JUNE 18, 1990)
Restricted Use: NO

Labels | Chemical | Alt Brand Name | Inactive Alt Brand Name | Transfer History | Site | Pest

EPA Reg. No.	Product Name	Accepted Date
6836-140	LONZA FORMULATION S-21F	January 31, 2019 (PDF)
6836-140	LONZA FORMULATION S-21F	March 13, 2018 (PDF)
6836-140	LONZA FORMULATION S-21F	March 23, 2017 (PDF)
6836-140	LONZA FORMULATION S-21F	September 14, 2016 (PDF)
6836-140	LONZA FORMULATION S-21F	June 25, 2015 (PDF)
6836-140	LONZA FORMULATION S-21F	April 02, 2014 (PDF)
6836-140	LONZA FORMULATION S-21F	March 06, 2014 (PDF)
6836-140	LONZA FORMULATION S-21F	June 12, 2013 (PDF)
6836-140	LONZA FORMULATION S-21F	September 24, 2012 (PDF)
6836-140	LONZA FORMULATION S-21F	August 02, 2012 (PDF)
6836-140	LONZA FORMULATION S-21F	February 16, 2012 (PDF)
6836-140	LONZA FORMULATION S-21F	February 25, 2010 (PDF)
6836-140	LONZA FORMULATION S-21F	August 31, 2009 (PDF)
6836-140	LONZA FORMULATION S-21F	August 14, 2007 (PDF)
6836-140	LONZA FORMULATION S-21F	February 08, 2007 (PDF)

row(s) 1 - 15 of 25 Next

Screenshot of the page 6 of the PDF selected in last slide



Use **Lonza Formulation S-21F**

- in federally inspected Meat & Poultry Plants as a food contact surface sanitizer and / or disinfectant. This product was authorized by USDA as category D2 under the prior authorization program and its formula has not been changed – a sanitizer for all surfaces not always requiring a rinse.
- as a disinfectant on hard, nonporous surfaces.
- in kitchens, bathrooms and other household areas.
- to clean and disinfect finished floors, sinks and tubs.
- with a mop and bucket, trigger sprayer, sponge or by soaking.
- for non-scratch cleaning of showers and tubs, shower doors and curtains, fixtures and toilet bowls.
- to clean and disinfect nonporous salon / barber tools and instruments: combs, brushes, scissors, blades and manicure instruments.
- for sanitizing and disinfecting of ultrasound transducers, probes, mammography compressor plates and other hard nonporous surfaces.
- to clean and disinfect finished floors. Must be applied with damp mop or autoscrubber. Cleans and disinfects without dulling gloss.
- on coils and drain pans of air conditioning and refrigeration equipment and heat pumps. Follow the directions for sanitization of non-food contact surfaces.
- To clean and disinfect nonporous fire fighting bunker / turnout gear; trousers; overcoats, gloves, boots, hoods, helmets, air masks.
- [on] [to clean and disinfect] [to clean and sanitize] nonporous personal protective safety equipment, wrestling headgear, boxing headgear, protective headgear, athletic helmets, hard hats, half mask respirators, full face breathing apparatus, gas masks, goggles, spectacles, face shields, hearing protectors, and ear muffs. Rinse all equipment that comes in prolonged contact with skin with clean warm water [about 120°F], and allow to air dry before reuse. [Precaution: Cleaning at 120°F temperature will avoid overheating and distortion of the personal safety equipment that would necessitate replacement.]
- [on] [to clean and disinfect] nonporous athletic mats, wrestling mats, gymnastic mats, exercise equipment and training tables.
- for Poultry Premise Sanitation [Hatcheries]: Egg Receiving Area, Egg Holding Area; Setter Room, Tray Dumping Area, Trays, Buggies, Racks, Egg Flats, Chick Holding Room, Hatchery Room, Chick Processing Area, Chick Loading Area, Poultry Buildings, Ceilings, Sidewalls and Floors, Drinkers and other Poultry House related equipment, and all other hard, nonporous surfaces in the Hatchery environment.
- for Swine Premise Sanitation: Waterers and Feeders, Hauling Equipment, Dressing Plants, Loading Equipment, Farrowing Barns and areas, Nursery blocks, Creep area, Chutes.
- for Farm Premise Sanitation of hard nonporous surfaces: floors, walls, feed racks, mangers, troughs, automatic feeders, fountains and waterers, forks, shovels, scrapers and other nonporous surfaces in barns, pens, stalls, chutes and other facilities and fixtures occupied or traversed by animals.
- in the laundry to control odors on musty bedding and linens. Test on a small inconspicuous area before using. **{Not for use in California}**
- in mildew stains in damp areas such as bathrooms, showers, kitchens, basements and laundry rooms.
- in work areas such as tool rooms and garages for odor control and light duty cleaning.
- to remove odors caused by flooding and smoke from fires.
- to clean and sanitize tables, chairs, and countertops
- as a [commercial] sanitizer on dishes, glassware, and utensils.
- as a sanitizer in bottling and beverage dispensing equipment.
- as a sanitizer in sanitary filling of bottles and cans.
- in sanitizing bottles or cans in the final rinse application, and for external spraying of filler and closing machines.
- as a sanitizer in beer fermentation and holding tanks.
- as a Food-Grade Shell Egg sanitizer, with best results achieved in water temperatures ranging from 78°-110°F. **Lonza Formulation S-21F** may be applied through, immersion tanks, foaming apparatus and low-pressure sprayers.

Cross-contamination is of major housekeeping concern. **Lonza Formulation S-21F** has been formulated to aid in the reduction of cross-contamination on treated surfaces not only in hospitals, but in schools, institutions and industry.

Lonza Formulation S-21F
EPA Reg. No. 6836-140
EPA Submission 2015-11-16

Page 6 of 26

"To clean and disinfect firefighting…air masks…"

"…half mask respirators, full face breathing apparatus, gas masks, goggles…"

If your chosen disinfectant has directions for different dilutions

List N: Products with Emerging Viral Pathogens AND Human Coronavirus claims for use against SARS-CoV-2

EPA Registration Number	Active Ingredient(s)	Product Name	Follow the disinfection directions and preparation for the following virus	Contact Time (in minutes)
6836-140	Quaternary ammonium	Lonza Formulation S-21F	Norovirus	10

Best Practice

- Disinfect equipment with proven disinfectants
  - Follow directions for use
- Rinse and allow equipment to dry before use
- Don't re-contaminate equipment after disinfection
- Maintain good hygiene
- Disinfect high-touch surfaces or equipment including cylinders and fill stations

DAN

Questions?

- For questions about disinfection, plans to move forward, or other dive safety or risk mitigation questions:
  - **RiskMitigation@DAN.org**
- For medical questions concerning COVID-19 as it applies to diving:
  - **Medic@DAN.org**