

Biosecurity Disinfection - FAQ

Frequently Asked Questions about Virkon® S

1. Why is Virkon® S best practice for biosecurity in Antarctica and sub-Antarctic islands?

Virkon® S has a high level of efficacy against a broad range of microbes (100 viruses, 400 bacteria, 60 fungi). Additionally, the effectiveness of Virkon® S is not affected by the cold temperatures (0-5°C) that are found in the Antarctic environment. Due to the remote nature of Antarctic travel, it is important to note the product (powder) state is not considered hazardous for transport. The bright pink colour of the solution reflects the activity and efficacy of the solution against microbes, making it easy to monitor for effectiveness. The dilution is easy and convenient to mix for use, and this type of disinfectant has a much lower level of toxicity for users and the environment, in contrast to other types of disinfectant.

2. How does Virkon® S work?

This is an oxidizing agent that works to add oxygen (and therefore remove electrons) from a substance to disrupt its functionality. Virkon® S is a peroxide-based compound that denatures proteins and lipids of microorganisms. The oxidation of proteins and other components of cell protoplasm results in inhibition of microbe enzyme systems and loss of cell-wall integrity.

3. What are the risks to humans that prepare and use it?

According to the Virkon® S Safety Data Sheet published in 2020, this is a category 2 skin irritant and category 1 eye irritant (out of 5 category levels, with 5 being the highest). To prevent any irritation or damage, skin should be covered when preparing a dilution. There is also a recommendation for protective glasses and masks if not preparing in a well-ventilated area. Be sure to wash skin thoroughly after handling (even when gloves are worn).

4. How should Virkon® S be stored, diluted, and prepared?

Virkon® S should be stored in a cool, dry environment. A 1% dilution is considered adequate for biosecurity practices and should be prepared with full skin coverage in a well-ventilated area (or while wearing suitable respiratory equipment). Temperatures above 40°C will deactivate the ingredients, so extremely hot water should not be used in dilution.

5. How do I know Virkon® S is working?

The bright pink colouration of the diluted Virkon® S solution indicates that there is a high activity of the compounds within working to break down and denature the proteins in microbes. Loss of bright pink colour/hue indicates a lack of efficacy and activity. The solution should be within a container that enables visualization of the colour and must be replaced when lack of efficacy (lack of colour) is indicated.

6. Why do we disinfect our boots on the way to a landing in addition to coming back from every landing?

Due to the risk of foreign materials and bacteria on ship floors – including mudrooms – footwear will need to be disinfected every time when leaving the vessel. There is no documented minimum contact time for Virkon® S. Additionally, there is no way to guarantee there are no foreign materials contacting footwear between disinfecting and leaving the vessel without repeating the disinfecting process during departure. The practice of disinfecting footwear when disembarking the vessel for operations remains best practice at this time.

7. Are there documented risks to the environment?

According to the safety profile, Virkon® S is not considered long-lasting in the environment (European standards) or a marine pollutant (US standards). The oxygen-based chemistry contains simple inorganic salts and organic acids. The active ingredient decomposes by a variety of routes, breaking down to form naturally occurring substances of potassium, salts, and oxygen.

8. What are the other types of disinfectants [solutions that target the removal of microbial organisms]?

- **Phenols**, which require the surface to remain wet for 10 minutes after application, and dilution required for disinfecting is a concentration that is considered highly toxic to all animals
- **Iodophors**, which can stain clothing, and are inactivated by sunlight
- **Quaternary ammonium**, which is not as widely effective against microbes, easily inactivated by organic matter soaps and hard water, and is toxic to fish
- **Aldehydes**, which are highly irritating and toxic to humans and animals with contact or inhalation, is classified as carcinogenic
- **Biguanides**, which is not widely effective, easily inactivated, and toxic to fish.

9. Why don't we use other disinfectants?

In addition to Virkon® being considered best practice, other types of disinfectants have not been tested in ways applicable to use in biosecurity outside of farming, agriculture, or medical settings. Similarly, other categories of disinfectant are already known to be toxic to humans, animals, or the environment.

Sources

Disinfectant directions and safety sheets

1. Virkon® S Chemical Disclosure and Safety Data Sheet
2. Virkon® S
3. Virkon® Aquatic
4. Fact Sheet on Different Types of Disinfectants

Studies on Virkon S

1. Ahmed, B.S. and Al-Hamdani, A.H. Histopathological Changes of Common Carp (*Cyprinus carpio*) Vital Organs Exposed to Virkon at Different Periods. *Egyptian Journal of Veterinary Sciences*. (2024).
2. Amass, S.F., Schneider, J.L., and Gaul, A.M. Evaluation of current and novel protocols for disinfection of airplane passenger footwear under simulated conditions. *Preventative Veterinary Medicine*. 71 (2005) 127-134.
3. Bartlett, J.C., Radcliffe, R.J., Convey, P., Hughes, K.A., and Hayward, S.A.L. The effectiveness of Virkon S disinfectant against an invasive insect and implications for Antarctic biosecurity practices. *Antarctic Science*. (2020).
4. Curry, C.H., McCarthy, J.S., Darragh, H.M., Wake R.A., Churchill, S.E., Robins, A.M., and Lowen, R.J. Identification of an agent suitable for disinfecting boots of visitors to the Antarctic. *Polar Record* 41 (216): 39 – 45 (2005).
5. Rumpf, S.B., Alsos, I.G., and Ware, C. Prevention of microbial species introduction to the Arctic: The efficacy of footwear disinfection measures on cruise ships. *NeoBiota*. 37 (2018) 37-49.

Other papers referenced

1. Barbosa, A., Varsani, A., Morandini, V., Grimaldi, W., Vanstreels, R.E.T., Diaz, J.I., Boulonier, T., Dewar, M., Gonzalez-Acuna, D., Gray, R., McMahon, C.R., Miller, G., Power, M., Gamble, A., and Wille, M. Risk assessment of SARS-CoV-2 in Antarctic wildlife. *Science of the Total Environment* 755 (2021) 143352.
2. Duarte, B., Gameiro, C., Matos, A.R., Figueiredo, A., Silva, M.A., Cordeiro, C., Cacador, I., Reis-Santos, P., Fonseca, V., Cabrita, M.T. First screening of biocides, persistent organic pollutants, pharmaceutical and personal care products in Antarctic phytoplankton from Deception Island by FT-IR-MS. *Chemosphere* 274 (2021) 129860.
3. Inter-continental Checklists for supply chain managers of the National Antarctic Programmes for the reduction in risk of transfer of non-native species (version May 2019). comnap.aq/handbooks-manuals-operational-guidelines.