Virkon® S

Disinfectant and Virucide*

Does Your Disinfectant Work In Winter?

Virkon® S is effective at cold temperature†, 5°C, against the following viruses:

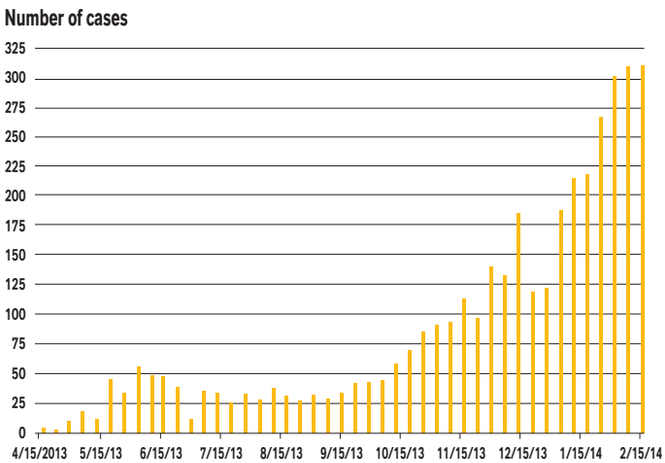
- **Avian Adenovirus Type 2**
- **Avian Infectious Bronchitis**
- **Avian Influenza virus**
- **Marek's Disease Virus**
- **PEDv**
- **PRRS**
- **Porcine Rotavirus**

Fall and winter pose new challenges as well as opportunities to enhance biosecurity protocols on the farm.

Viral challenges like Avian Influenza (AI), Porcine Reproductive and Respiratory Syndrome (PRRS) and Porcine Epidemic Diarrhea (PEDv) are sometimes referred to as "seasonal" outbreaks. Cooler temperatures bring migratory waterfowl into the region, which carry Avian Influenza. AI can survive for 35 days at 4°C/39°F. According to data from the USDA and the American Association of Swine Veterinarians, the number of PEDv cases rose significantly during the colder months during the 2013-2014 outbreak, which killed millions of pigs.

The movement of pigs was considered the primary vector of PEDv and PRRS transmission. Therefore, it is vital trailers and transportation vehicles are disinfected using products, which can perform under the environmental conditions in which they are being used.

Outbreak of Porcine Epidemic Diarrhea Virus (PEDv) by week; April 15, 2013 - February 16, 2014



Source: USDA, Economic Research Service using data from the American Association of Swine Veterinarians.

Disinfectants are required to pass efficacy testing at room temperature (22°C/72°F) for EPA approval. Rarely, is this the case in real world applications. Temperature can play a major role in the efficacy of a disinfectant. The ability of a disinfectant to work well at low temperatures contributes to the value of its use on a daily basis. It is well documented the efficacy of some disinfectant chemistries, such as aldehydes, including glutaraldehyde, as well as quaternary ammonium compounds can decrease as temperatures decrease. This can result in the disinfectant solution becoming ineffective against the pathogens of concern[1].

In addition, exposing certain bacteria to sub-lethal doses of antimicrobials, can lead to resistance further complicating the situation. There are hundreds of thousands of scholarly journal articles documenting cases of resistance including:

Bacterial Biocide Resistance

- ***E. coli:*** QACs (Soumet et al., 2012, Nhung et al., 2015)
- ***Salmonella:*** QACs (Nhung et al., 2015)
- ***Pseudomonas:***
  > Glutaraldehyde (Tschudin-Sutter et al, 2011)
  > QACs (Jones et al. 1989, Mechin et al. 1999)
  > Chlorhexidine (Bamber and Neal, 1999)
- ***Klebsiella:*** Chlorhexidine (Wand et al., 2019)
- ***Staph. aureus:*** QACs, Chlorhexidine (Suller and Russell, 1999)
- ***Bacillus:*** Glutaraldehyde (Fisher et al., 2012)

In order to compensate for any loss of efficacy under cold conditions, corrective actions may include raising the temperature, as in "baking" transport trailers. This comes at a very high cost in facilities, equipment and energy. Increasing the contact time of the disinfectant solution could help given the surface being disinfected remains wet, which may not be possible in freezing temperatures. Increasing concentration of the solution may speed up the rate of kill but comes at a risk of increased toxicity and higher cost in use.

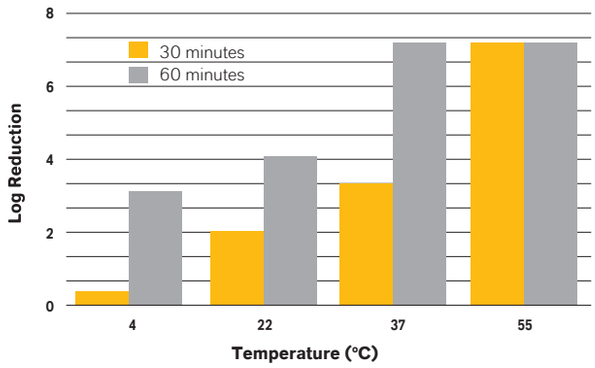
Chemical Reactions In Cold Temperature

In order to understand how low temperature can negatively impact efficacy, we must first understand the mode of action of the chemistry used.

Aldehydes mechanism of disinfection is based on the inhibition by polymerization or gelation of the membrane of the microbe. The rate of this reaction is dependent on the ability of the protein coming into contact with the antimicrobial. This reaction rate decreases with decreasing temperature.

Data from a glutaraldehyde manufacturer, shows the dramatic decrease in efficacy that temperature has on efficacy. A 4 log reduction is required for disinfection. Their data shows that in order to achieve a 4 log reduction of E.coli at room temperature, 22°C/72°F a 60 minute contact time is needed.

Effect of Temperature on Efficacy *organism: E.coli pH: 7.5 concentration: 20ppm active*



Effect at cold Temperature - Glutaraldehyde

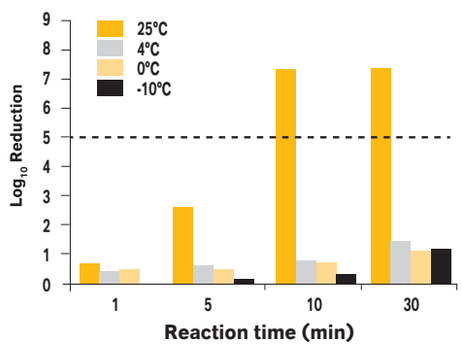
During cold temperatures:

- 4°C, 39°F efficacy is 2.8 Log Reduction, 60 minutes.
- 22°C, 72°F efficacy for a 4 Log Reduction, 60 minutes.

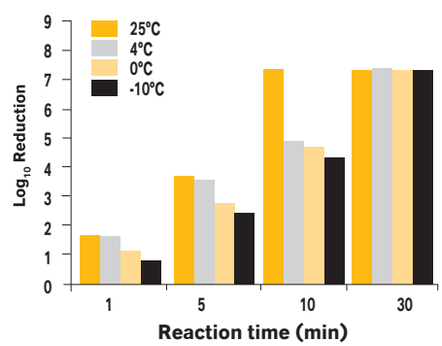
During cold temperatures, this results in longer contact times or higher concentration (than originally stated on the label).

In a comparison suspension study[2] by Jang et al in 2017, glutaraldehyde only delivered a >4 log reduction needed for disinfection at 25°C/77°F in 10 minutes. At 4°C/39°F and less, glutaraldehyde at 1% concentration was unable to provide a 4 log reduction in 30 minutes. Potassium peroxymonosulfate (Virkon® S at 0.5%) however achieved >4 log reduction in 10 minutes at temperatures as low as -10°C/14°F.

Glutaraldehyde - 1.0%



Virkon® S - 0.5%



Quaternary ammonia compounds disinfect based on denaturation (disentanglement or unraveling) of the protein shell of the microbe. Denaturation of the protein is heavily based on mobility and is highly dependent on temperature. As temperature decreases, it affects the denaturation speed and therefore may decrease the efficacy of quat-based disinfectants.

Oxidative Chemistry

Conversely, Virkon® S maintains effective activity against specific viruses at 5°C/41°F, eliminating the need to increase contact time or concentration. Virkon® S is oxidative chemistry, which is not impacted by cold temperature.

The mode of action of oxidizing disinfectants is based on radical-ion reactions. The oxidation of the cell is a continuous reaction, which creates new radicals and ions independent of temperature. The radical ions break up the protein found inside of the membrane of the microbe. Cold temperatures tend not to interfere with this reaction and therefore, the efficacy remains relatively stable.

Therefore, oxidizing compounds can be used during warm or cold weather conditions without showing a decrease in reaction rate or efficacy of the disinfectant. Virkon® S maintains effective activity against disease-causing organisms at 5°C/41°F, eliminating the need to increase contact time (10 minutes) or concentration of the disinfectant solution. Ten minutes is all it takes to prevent disease-causing organisms from affecting your live production, in cold and warm weather conditions.

Virkon® S - Independently proven efficacy

Pathogen	Concentration	Contact Time	Temp.
Avian Adenovirus Type 2	1:200	10 min	5°C
Avian Infectious Bronchitis	1:200	10 min	5°C
Avian Infectious Bronchitis	1:200	1 min	5°C
Avian Influenza	1:200	10 min	5°C
Avian Influenza	1:200	1 min	5°C
Avian Infectious Laryngotracheitis	1:200	10 min	5°C
Marek's Disease Virus	1:200	10 min	5°C
PEDv	1:200	10 min	5°C
PEDv	1:200	1 min	5°C
PEDv	1:600	10 min	5°C
PRRS	1:600	10 min	5°C
Porcine Rotavirus	1:600	10 min	5°C

† - Not approved for this use in California

Please consult the Virkon® S product container label for a comprehensive list of organisms and directions for use.

Efficacy is specific to noted viruses based on dilution rate, contact time and/or temperature.

Product Presentation

Virkon® S 22lb Pail

Virkon® S 10lb. Pail

Virkon® S Tablets

References

1. Low Temperature Performance of Disinfectants. Axcentive. The Poultry Site. February 2016. http://www.thepoultrysite.com/articles/3610/low-temperature-performance-of-disinfectants/
2. Jang Y, Kwangjick L, Seonjong Y, Myoungheon, L, Jaeyoung S, Byungjoon, C, Nong-hoon C. Efficacy evaluation of commercial disinfectants by using *Salmonella enterica* serovar *Typhimurium* as a test organism. J Vet Sci. 2017 Jun; 18(2): 209–216.

LANXESS
Energizing Chemistry

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