

**STEAMERY**  
Stockholm

## STUDY ON INACTIVATION OF VIRUS BY USING HEAT TRANSFER BY STEAM

### *SUMMARY & INSIGHTS*

#### **Background**

At Steamery Stockholm we currently get a lot of questions from customers regarding steam heat and whether it can inactivate viruses on garments. We decided to investigate the relation between heat transfer by steam from our steamers and inactivation of viruses. Therefore, we reached out to RISE (Research Institutes of Sweden), one of Europe's largest research institutes, to have them perform the testing.

Below, we have summarized the test methods and results. If you have any questions or comments, please contact us at [info@steamery.se](mailto:info@steamery.se).

#### **Garment and Materials**

Steamery decided that the testing should be made on gloves, since this is a type of garment that, similarly to our hands, is commonly exposed to viruses and bacteria. RISE performed the test on three types of gloves: cotton, ski\* and leather gloves.

\*Outer shell made by polyester, padding made by polyester and lining made by polyester fleece.



## Methods

The RISE research team performed two different types of test-sets, using two different methods to investigate the inactivation of virus through steam.

During Experiment No.1 they steamed the gloves for five minutes in the open air, on a flat surface. During Experiment No.2 they put the gloves inside a heat protection bag and steamed for one minute. When steaming the gloves, the surface and inside temperatures were measured with thermocouples, and for the first test-set a heat camera took pictures every ten seconds to register the outside heat temperatures of the gloves. The RISE team then compared the achieved temperatures with known inactivation data for the different viruses, mentioned below, in order to conclude the inactivation results.

## Viruses Included in the Tests

A. Well established model viruses for the human Norovirus which causes “Winter Vomiting Disease”:

- **Murine Norovirus**
- **Feline Calicivirus**

B. Pathogenic Coronaviruses:

- **SARS-CoV** (Severe Acute Respiratory Syndrome, also called SARS-CoV-1)
- **Canine coronavirus** (CCoV) is a common cause of viral enteritis among dogs. CCoV is also a model virus for human coronaviruses.
- **MERS-CoV** (Middle East Respiratory Syndrome).

Scientific studies have revealed that SARS-CoV-2, the causative agent of Covid-19, is similar in structure and pathogenicity as SARS-CoV. At the time of the experimental work there was no publicly available data regarding heat inactivation of SARS-CoV-2, and therefore this work has been based on data regarding SARS-CoV. Recently, the similarities regarding inactivation of SARS-CoV-2 and SARS-CoV have been confirmed in a scientific study published at the Lancet Microbe, Correspondence.

## Experiment No.1: Heat in Open Air

### Type of Steamer Used

The test was performed with Steamery's steamers Stratus No.2, Cirrus No.2 and Cumulus No.3.

### Steaming Time

Between one and five minutes.

### Steaming

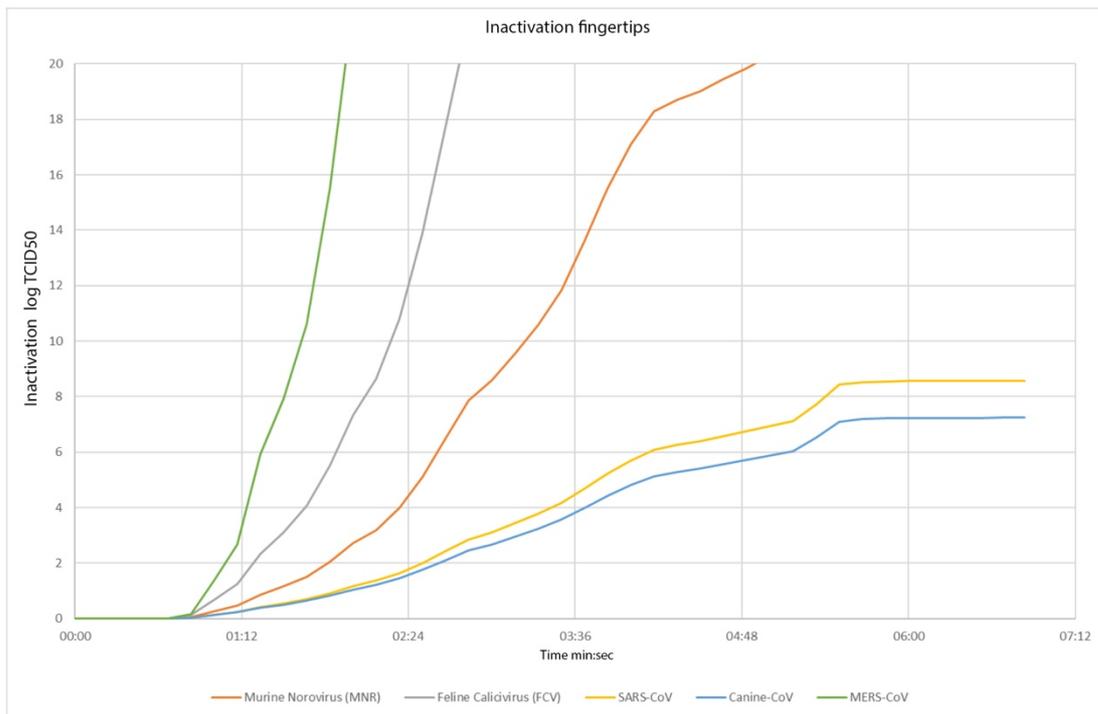
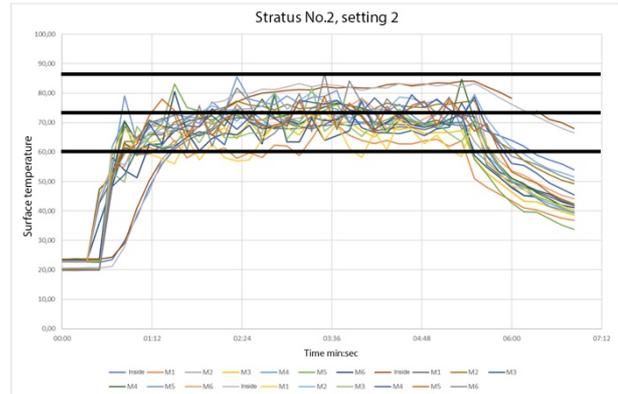
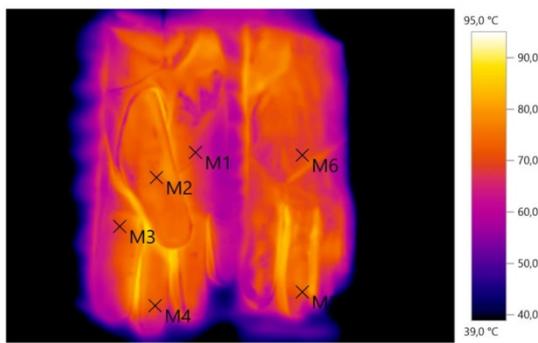
The gloves were steamed during five minutes in the open air on a flat surface.



### Results Experiment No.1

The results showed that the viruses were only inactivated on some parts of the textile, where temperatures would reach 80°C. As the heat transfer wasn't even across the whole fabric the levels of virus inactivation would not be sufficient to define the textile as sterile.

The RISE team further concluded that the test results didn't differ depending on the type of steamer used; it rather depended on the glove material, the technique used when steaming, and the fact that the steam quickly cooled off once it reached the surface of the textiles.



Log inactivation measures the effectiveness of the disinfection process (the number or percent of microorganisms inactivated through the disinfection process).

For example, a 3 log inactivation value means that 99.9% of microorganisms of interest have been inactivated.

Log Inactivation:

- 1 log: 90% inactivation
- 2 log: 99% inactivation
- 3 log: 99.9% inactivation
- 4 log: 99.99% inactivation

More interesting, we (Steamery and RISE) found that the temperatures inside the leather glove would reach stable levels of more than 85°C, which is sufficient to inactivate any of the given viruses during a steaming time of one minute.

Therefore, Steamery decided to optimize the method by captivating the heat and asked RISE to carry out a second experiment.

## **Experiment No.2: Heat Protection Bag**

In this experiment the RISE research team steamed the gloves inside a Steamery heat protection bag in order to isolate the steam heat and reach higher, even and sustained temperatures in a short period of time. The tests were carried out with several replicates, on different types of gloves, by different performers, and with different method instructions given to the different performers.

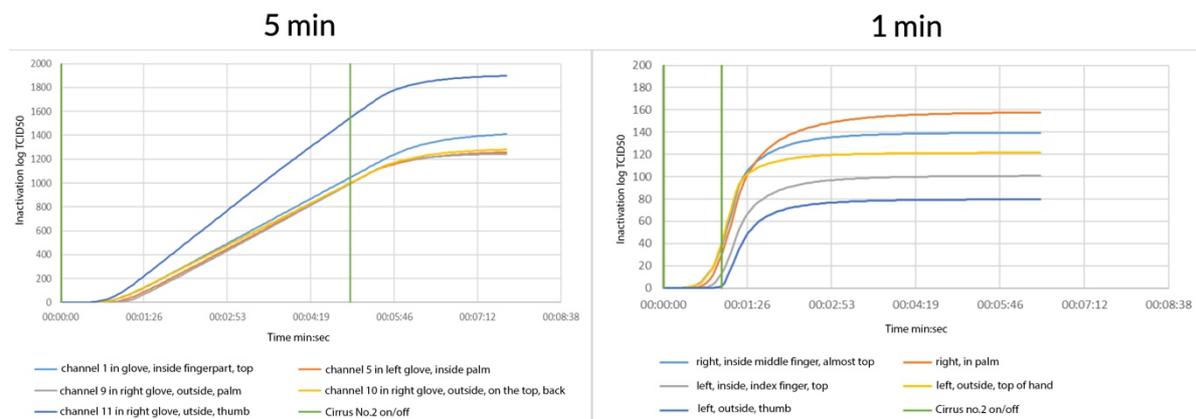
### **Type of Steamer Used**

Cirrus No.2, including the Steamery Heat Protection Bag that comes with the product.

### **Steaming**

A one minute long initial steaming period of the gloves inside the heat protection bag, followed by a five minute “cool down period” inside the closed heat protection bag.

1. The gloves were placed in the Heat Protection Bag from Steamery.
2. The Heat Protection Bag was pulled over the nozzle of the Cirrus No.2.
3. The strap on the heat protection bag was sealed around the nozzle, to keep the heat inside the heat protection bag.
4. The team steamed for one minute and moved around the heat protection bag a bit at the same time.
5. After one minute, the steamer was removed, and the heat protection bag was completely sealed.
6. The gloves were left inside the heat protection bag for five minutes to cool off before taking them out.



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## Results Experiment No.2

Using this alternative method, the achieved heat levels inside the Heat Protection Bag were so high (around 100°C) that all five viruses were inactivated after only one minute of continuous steaming (given that the Heat Protection Bag was entirely closed, and the gloves were left inside the bag for five minutes after finishing steaming).

## Summary and Next Steps

Given the above research and results, we have identified that it is possible to inactivate the listed viruses on gloves by using a steamer in combination with a heat protection bag. We have now registered a patent for this method. More extended tests and research will be made together with RISE during the coming months and more findings will be presented thereafter.

## Disclaimers

Note that:

- This test has so far only been done on **gloves** in certain materials.

- Note that there is limited data regarding heat inactivation for SARS Cov-2, hence our result is the best to our present knowledge.
- Steaming cannot fully prevent the risk of virus infection, as this will depend on other factors.
- Our steamers and heat protection bags are currently not designed to be used by consumers in the way they were used during the experiment made by RISE.
- If choosing to use the products as in the experiment that is at the individual's own risk. Hot steam may come out of the heat protection bag. If you have a glove at home, we recommend you carry it on the hand that presses the steaming button, in order to prevent yourself from getting burned by the steam.
- Note that after one minute of steaming in the closed heat protection bag the steam temperature in the heat protection bag will be around 100°C. Not all clothes and materials tolerate this heat. Before steaming, make sure that your garment can withstand this heat.
- Our products are not certified for clinical environments, such as hospitals or health clinics.

## **S T E A M E R Y**

Stockholm