National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

FRONT OFFICE FOOD AND PRODUCT SAFETY

Assessment of transmission routes that could create a risk of SARS-CoV-2 transmission in a hospitality industry setting.

Risk assessment requested by:	Office for Risk Assessment & Research (BuRO)
Risk assessment drawn up by:	RIVM
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Subject

Currently, bars and restaurants in the Netherlands are closed because of the COVID-19 crisis. These locations will open again at a time when COVID-19 has not yet completely disappeared from the consumer population. Measures may therefore be taken to minimise the transmission of the virus (the so-called '1.5 metre society', including frequent hand washing, elbow sneezing, etc.).

In addition to direct droplet transmission of the virus (through coughing, sneezing), which can be controlled by the '1.5 metre society' measures, indirect transmission is also possible (through hands, door handles and other surfaces).
The Netherlands Food and Consumer Product Safety Authority (NVWA) monitors food safety and related hygiene in the hospitality industry, and can make a risk-oriented contribution by monitoring specific hygiene measures in the hospitality industry. However, not much is known about the possible transmission of COVID-19 through food contact surfaces.

Relevant laws and regulations:
The Hygiene Code for the hospitality industry (Koninklijke Horeca Nederland), which has been documented as a good practice guide, as referred to in Articles 1 and Chapter III of Regulation (EC) No. 852/2004 ('hygiene of foodstuffs').
Guidelines of Koninklijke Horeca Nederland (dated 19/5/2020):

- Customers must make a reservation for an indoor table. Booking a table at the door prior to entry is also considered making a reservation, provided triage is applied, the maximum of 30 persons in the room is not exceeded, and the distance of 1.5 metres can be maintained.
- Maximum 4 persons per table.
- Upon entry, customers must also wash their hands or disinfect them with disinfecting hand gel

- Before a customer is allowed to enter, they are asked a number of questions (confirmation that the customer (and any member of their household) is symptom-free).
- Clean chairs, tables and menu cards thoroughly when customers leave and new ones are seated.

Research question

1. Are there any transmission routes in hospitality industry settings that give a higher, or additional, risk of transmission than if a COVID-19 patient remains at 1.5 metres from a healthy consumer?
2. Specifically calculate the risk of transmission from an (asymptomatic) patient (consumer) to a healthy person (hospitality industry employees/other consumer) via glasses/sink, cutlery and/or crockery (plates).

The following two elements should be included in the answer:

- If general measures are taken in the hospitality industry to comply with the '1.5 metre society' (i.e. distancing and good hand hygiene), are there any other significant transmission routes?
- Potential measures for businesses to reduce transmission where necessary that are at least as effective as distancing and good hand hygiene.

Conclusions

The exact risk of transmission of SARS-CoV-2 from a COVID-19 infected person to a healthy consumer 1.5 metres away has not yet been quantified. It is therefore not possible to estimate whether other possible transmission routes cause a higher risk of transmission than that of transmission at 1.5 metres. Any additional potential transmission routes have been mapped out, and the transmission potential has been estimated. The main conclusions are described below:

1) Exposure to SARS-CoV-2 by drinking from a rinsed glass that has been used by a person infected with SARS-CoV-2 is a real possibility. The risk of exposure through this route can be reduced by adding an additional step to the glass rinsing procedure (cleaning the rim of the glass with alcohol) or washing glasses in a dishwasher.
   The risk that an infected person will visit a hospitality business (and infects glasses) depends on the number of patrons in such a location and the prevalence of the virus: At this time, that risk is minor for individual locations, but with >60,000 locations (https://www.cbs.nl/nl-nl/economie/handel-en-horeca), it is potentially a relevant factor in the transmission of COVID-19.
   Note: In Germany, the first post-lockdown COVID-19 restaurant outbreak has already been reported: https://www.dw.com/en/german-covid-19-outbreak-traced-to-restaurant/a-53547360. This outbreak is believed to have resulted from a failure to follow the general guidelines.

2) The low number of viruses entering the rinse water, the dilution in the rinse water and the inactivation of the virus by the soap solution present in the rinse water make the risk of droplet transmission through this route so small that no additional measures are recommended.

3) These concentrations of infectious SARS-CoV-2 in rinse water are so low that the risk of exposure while drinking from a glass contaminated by cross contamination through the rinse water is negligible.

4) The likelihood of infectious virus on plates and cutlery coming from the dishwasher is very low, so the use of plates and cutlery from the dishwasher does not lead to an additional risk. However, it is essential to avoid contamination of plates and cutlery after washing to minimise the possibility of transmission. Additional measures should be taken for this purpose.

For a picture of the number of SARS-CoV-2 infections among hospitality industry patrons, it has been estimated, on the basis of RIVM data of 26 May 2020, that, at that time, 1:1000 to 1:10,000 people were asymptomatically infected with SARS-CoV-2 in the Netherlands. This means that in groups of up to 30 people, the risk that someone is infected is < 3%. This person might infect others if they do not observe 1.5 metre distancing, or through contaminated glasses, plates or cutlery. In the latter case, the risk of transmission of the virus is greatest if a rinsed glass is reused.

Introduction

From 1 June, the hospitality industry will open again, with a maximum number 30 patrons (at a time). These people may not have any symptoms of a cold or fever. As a result of the symptom check, hospitality establishments should have no symptomatic patrons. However, it is also known that asymptomatic and pre-symptomatic excretion can be as high as symptomatic excretion, based on Cycle Threshold (CT) values of polymerase chain reaction (PCR) on nose/throat swabs (He et al., 2020). Just as coughing and sneezing, talking and singing also lead to virus excretion (Xie et al., 2009; Wilson et al., 2020). Because viral load tends to decrease at the end of infections, post-symptomatic excretions are considered to be less important with regard to transmission. Faecal excretion has been shown to persist after respiratory symptoms have disappeared. However, the faecal-oral route is sufficiently limited by the prescribed good hand hygiene and sensitivity of SARS-CoV-2 to hand alcohol (Kratzel et al., 2020).

Prevalence

From the RIVM data dated 18 May 2020, it was estimated that at that time in the Netherlands, up to 1 in 750 people had an asymptomatic SARS-CoV-2 infection. This was determined by adding all confirmed SARS-CoV-2 positive tests over a period of 3 weeks (5725 people), multiplying this number by 4 (80% of infected people have no or mild symptoms and are not tested), and dividing it by the Dutch population (17 million). This means that one asymptomatic infected person may be present in one in every 25 groups of 30 patrons. For this maximum estimate, it has been assumed that people who are and remain asymptomatic continue to excrete the virus for 3 weeks, just as COVID-19 patients. However, Liu et al. (2020) show that 90% of asymptomatic infected people only test positively with nose-throat swabs for 10 days. The prevalence in the Netherlands has continued to decrease since 18 May. Currently (26 May 2020), it is estimated that 1:1000 to 1:10,000 people without symptoms will test positive for SARS-CoV-2 in a nose-throat swab. This means that the chance that a group of 30 patrons contains an infected person is currently < 3%.

Transmission routes

The risk of the transmission of the virus within 1.5 m and without interventions is high, with a 30-50% risk of household transmission (Wang et al., 2020). The exact risk of transmission of SARS-CoV-2 from a COVID-19 infected person to a healthy consumer 1.5 metres away has not yet been quantified. It is therefore not possible to estimate whether other possible transmission routes provide a higher risk of transmission than that of transmission at 1.5 metres. To assess any additional potential transmission routes, a systematic description using scenarios has been set up to describe which transmission routes can potentially play a role. Below is an overview of potential transmission routes.

1) General: Transmission routes that apply everywhere and that are subject to national restrictive measures
   - Direct: Through droplets (particles > 60 µm (Liu et al., 2017)), excreted by infected persons.
   - Transmission via surfaces contaminated with SARS-CoV-2 by droplet contamination through coughing, sneezing and speaking.
   - Faecal/oral via hands (classical risks of infectious diseases with faecal/oral transmission)
   - Through aerosols (this is still being studied)

2 Hospitality industry-specific:
   - Exposure by inhaling droplets (and aerosols) formed during the rinsing of contaminated glasses at the bar/tap and during the rinsing of glasses, plates and cutlery in the dishwashing area.
   - Transmission via plates and cutlery
   - Transmission via glass

Table 1: Overview of possible transmission routes of SARS-CoV-2 in the hospitality industry and treatment in this risk assessment

	Route	**Risk assessment**
General	Droplets	No
	Via surfaces contaminated by coughing, sneezing, talking	No
	Faecal/oral (through hands)	No
	Aerosols	No
Hospitality industry-specific	Drops/aerosols from rinse water	Yes
	Via plates and cutlery	Yes
	Via glasses	Yes

Table 1 gives an overview of possible transmission routes of SARS-CoV-2 in the hospitality industry. The general transmission routes are not included in this review. The direct spread of SARS-CoV-2 via droplets after coughing, sneezing, talking is reduced by staying at home with symptoms and keeping a 1.5 m distance from other people. The indirect droplet route via surfaces and hand-mouth/nose/eye contact, and the faecal/oral route are reduced by good hand hygiene and cleaning.

The role of aerosols in the spread of SARS-CoV-2 is currently being studied. If aerosol transmission plays a relevant role, 1.5 m distancing could be insufficient to prevent transmission, especially in a confined room. The spread of the virus through aerosols is

still unclear and is therefore not included in this review, pending the results of the study in question.

The biggest specific risks for the hospitality are through contact with contaminated surfaces, such as glasses, plates and cutlery. Glasses are briefly rinsed in a rinse sink, with glass rinse brushes, in which case the inside of the glasses is also cleaned mechanically with brushes. Multi-brush systems are available for thoroughly cleaning the outside of the glass ; the proper operation of a serial 3-brush system, in particular, will determine how efficient this cleaning is. Soap is present in the rinse water, which may reduce the infectivity of the virus.

The transmission of pathogens via glass, plates and cutlery can take place in several ways:

1) The reuse of rinsed glasses, with residual saliva present.
2) The use of glasses contaminated by cross contamination when rinsing in rinse water.
3) When rinsing the glasses, droplets and aerosols can form and droplets may stick to the rinsed glasses.
4) Via plates, glasses, cutlery etc. that are contaminated by coughing or talking patrons and/or employees with an infection.

The risks of the above-mentioned transmission routes for SARS-CoV-2 will analysed in more detail below using described scenarios.

Scenarios

1) *Transmission via droplets and aerosols formed during the rinsing of glasses.*

   Scenario:
   1 glass with SARS-CoV-2 contaminated saliva in the sink

   Sink = 10 L
   The titre SARS-CoV-2 in saliva: on average 3.3×10^6 (range 990 - 1.2×10^8) genome copies/mL) ((10)(2e) To et al., 2020)
   Amount of saliva on glass: 100 µL (RIVM estimate, no hard data)
   Amount of virus on glass: 3.3×10^5 (99 - 1.2×10^7) genome copies)
   Effect of dilution in 10 L sink: 3.3×10^5 (99 - 1.2×10^7 genome copies/10 L) = 33 (0 - 1200) genome copies/mL rinse water).

   From a virus isolate, the genome copy/infectious virus ratio is estimated to be 1 infectious particle per 55 genome copies, based on RIVM figures

   Immediately after rinsing, and assuming that all saliva with infectious viruses enters the rinse water (worst case for rinse water), the concentration of infectious SARS-CoV-2 viruses could vary from 0-218 per mL of rinse water.

   Droplets that can be created as splashes from the sink can be up to 10-50 µL in size (depending, for example, on the quality of the water, the temperature, or how the droplet develops). This means that, in the event of droplet formation immediately after rinsing an infected glass, at least some of the droplets could contain infectious virus, and that the largest drops (50 µL, r=2.25 mm) could contain up to 11 (=218/20) infectious viruses per drop. (For comparison: a drop of saliva with a radius of 80 µm (volume = 0.002 µL) of a secreter with Ct 25 in the PCR contains an equal number of viruses).

Inactivation of SARS-CoV-2 in rinse water with the prescribed amount of beer glass cleaner is set at 90-99% reduction in infectious viruses in 30 minutes (at room temperature) (see Annex 1).
This means that the SARS-CoV-2 concentration in the rinse water is further reduced to 0 – 2 infectious viruses/mL rinse water half an hour after a contaminated glass has been washed. At that point, the number of infectious viruses per drop of rinse water is so low that the risk of direct droplet transmission is very low. Indirect droplet transmission via surfaces is very unlikely.

2) *Reuse of rinsed glasses:*

1 glass with SARS-CoV-2 contamination
Concentration in saliva: 3.3×10^6 ($990 - 1.2 \times 10^8$) genome copies/mL
Amount of saliva on glass: 100 µL (assumption, no hard data)
The circumference of the glass is 18-28 cm; the area where the lips touch the glass is 2-4 cm. If a glass is drained in 5 sips, 50% of the glass rim contains or could contain saliva residue on average. The risk of the next user touching an infected piece of the glass rim is about 50%.

Scenario 2a:
"Worst case": No virus reduction when cleaning, glass-lip contact of secreter at the same location on the glass as second user, 100% transfer of virus from glass to mouth.
Amount of virus on glass: 330,000 ($99 - 1.2 \times 10^7$) genome copies
Inactivation/removal by rinsing in sink: no virus removal.
Amount of virus on rinsed glass: 330,000 ($99 - 1.2 \times 10^7$) genome copies
Oral exposure: all the viruses enter the mouth: 330,000 ($99 - 1.2 \times 10^7$) genome copies

Assuming that one of the 55 genome copies has come from an infectious SARS-CoV-2 particle, oral exposure is 330,000/55 = 6000 (1.8 – 220,000) infectious viruses.
The risk of exposure to infectious SARS-CoV-2 is high (indicative >50%).

Scenario 2b:
Realistic: 99% virus reduction when cleaning, glass-lip contact of secreter at same location on the glass as second user, 0.1-10% transfer of virus from glass to mouth (based on transfer rates as described in Tuladhar et al., 2013).
Amount of virus on rinsed glass: 3,300 ($1 - 1.2 \times 10^5$) genome copies
Mucosal exposure: transfer of 10% of the virus in the mouth: 330 ($0.1 - 1.2 \times 10^4$) genome copies
0.1% of the virus in the mouth: 3.3 ($0.001 - 1.2 \times 10^2$) genome copies.

If 1:55 of the genome copies is infectious, and the virus transfer is between 0.1 and 10%, 0-218 infectious viruses may enter the mouth.

The risk of exposure to infectious SARS-CoV-2 is medium. The maximum dose in this scenario is approximately the same size as the infectious dose. (https://www.sciencemediacentre.org/expert-reaction-to-questions-about-covid-19-and-viral-load/).

Scenario 2c:
Cleaning the glasses in the dishwasher or extra cleaning with 60-80% alcohol wipe before brush rinsing is expected to reduce the virus load by 4^{10} log. No infectious virus residue is expected on the glasses and therefore no exposure will occur.

3) *Cross contamination during rinsing:*

Scenario:
20 drops of rinse water remain on a glass that has been rinsed in the sink 30 minutes after a contaminated glass has been rinsed:

as estimated under exposure route 1, the concentration of viruses after 30 minutes of incubation in the sink is: 0 – 2 infectious SARS-CoV-2 particles per mL of rinse water. Suppose 20 drops of 50 µL each remain on the rinsed glass. This is a total of 1 mL, i.e. 0 – 2 infectious viruses per rinsed glass (at room temperature and with recommended concentrations of beer glass cleaner).

4) *Via plates, glasses, cutlery etc. that are contaminated by coughing or talking patrons and/or employees with an infection.*

Scenario 4a:
Reuse of plates and cutlery that have been cleaned in a dishwasher.

The following information has been used with regard to dishwashers: Household dishwashers: washing temperature 55-65°C, during 20 to 60 minutes, followed by thermal disinfection, where the crockery reaches a surface temperature of 80-85°C. Professional machine dishwashing processes with multi-tank machines: pre-wash zone (35-45°C), wash zone (55-65°C) and rinse zone (80-85°C) (https://www.rhima.nl/over/haccp-spoelkeuken).

The contamination reducing potential of dishwashers is determined by mechanical reduction (rinsing) and inactivation (by soap and heat). SARS-CoV-2 is an envelope virus that can remain infectious for up to a few days on non-porous surfaces at room temperature (Ren et al., 2020), but quickly inactivates at higher temperatures (>60 °C) and high humidity (humidity or in suspension) (Kampf et al., 2020; Pastorino et al., 2020). The probability of infectious virus being present on plates and cutlery that have been washed in a dishwasher is therefore very low.

Scenario 4b: Droplet and aerosol formation while manually pre-washing the dishes.

Plates, cutlery and glasses that may have been contaminated by droplets or contact. The highest levels of contamination are expected on the rims of glasses and cutlery due to direct contact with the mouth. It is expected that cutlery and glasses are not usually pre-rinsed manually. Other items, such as plates, can be contaminated with SARS-CoV-2 by droplets that are excreted during talking. Based on the particle size distribution in the range of 5 to 1,000 µm during loud speaking, according to Duguid (1946), and the number of particles exhaled in 20 minutes according to Asadi et al. (2019), it can be estimated that 1 µL of droplets and aerosols is exhaled on average per minute. This volume is largely made up of larger droplets, which can fall on a plate.

At an average concentration of 10,000 viruses per mL, 200 viruses will land on a plate in 20 minutes; in case of high excretion of 100 million viruses per mL, this will result in 2 million viruses. That is a lot.
When a potentially highly contaminated plate is rinsed vigorously, the viruses rinsed from the plate will be diluted, but the presence of droplets with infectious virus cannot be ruled out. The advice is not to pre-wash or to wear protection against drops when pre-washing.

Risk assessment

1) *Transmission via droplets and aerosols formed during the rinsing of glasses:*

To determine the risk of exposure leading to infection or disease, a dose response relationship must be known, both for the risk of infection and for the risk of becoming ill after infection. For SARS-CoV-2, this is not known. Based on other beta corona viruses (MERS and SARS-CoV-1), it is assumed that this is between dozens and thousands of infectious viruses (https://www.sciencemediacentre.org/expert-reaction-to-questions-about-covid-19-and-viral-load/). For SARS-CoV-1, the infectious dose for the risk of illness after inhalation exposure has been described: the dose of SARS-CoV-1 needed to cause disease in 10% and 50% of exposed persons was 43 Plaque Forming Units (PFU, infectious viruses) and 280 PFU, respectively (Watanabe 2010).

The low number of viruses ending up in the rinse water, the dilution in the rinse water and the inactivation of the virus by the soap solution present in the rinse water make the risk of droplet transmission via this route so small that no additional measures are recommended.

Inactivation of SARS-CoV-2 in rinse water with a specified amount of beer glass cleaner with a factor of 10-100 (every half hour, room temperature, prescribed concentration of beer glass cleaner) leads to a very low risk of accumulation of higher concentrations of infectious SARS-CoV-2 in rinse water. Inactivation depends on time and dose. It is therefore important to keep the concentration of beer glass cleaner at the prescribed level.

2) *Reuse of rinsed glasses:*

In the worst-case scenario, exposure to SARS-CoV-2 via ingestion of the virus present on the outside of a rinsed glass is 6,000 (1.8 – 220,000) infectious viruses. To determine the likelihood of exposure leading to infection, a dose response relationship should be determined for ingestion exposure. The dose response relationship known for SARS-CoV-1 is related to the risk of illness after inhalation exposure.

Assuming that the infectious dose varies from 10-1,000 viruses, the risk of infection from exposure to SARS-CoV-2 by direct "contaminated surface-mouth contact" from a contaminated glass, in the worst case scenario, where rinsing has no effect and all of the virus present on a glass ends up in the mouth of the second patron, is very plausible.
In the more realistic scenario, where glasses are rinsed well and the virus transfer rate is 0.1-10%, there is still a small risk of exposure to infectious virus.

Further reduction of the risk can be achieved by adding an extra step in the glass cleaning process, e.g. cleaning the rim of the glass with a 60-80% alcohol wipe before rinsing), or using standard dishwashers for all glasses.

3) *Cross contamination during rinsing:*

The concentrations of infectious SARS-CoV-2 in rinse water are so low that the risk of exposure while drinking from a glass that has been cross contaminated via contact with rinse water is negligible.

4) *Via plates, glasses, cutlery etc. that are contaminated through coughing, sneezing or talking by infected visitors and/or employees.*

Scenario 4a: Reuse of plates and cutlery that have been cleaned in a dishwasher.

The likelihood of the presence of infectious virus on plates and cutlery that have been washed in a dishwasher is very low, so using plates and cutlery from the dishwasher does not lead to an additional risk of transmission.

However, it is essential to avoid contamination of plates and cutlery after washing. These should therefore be stored in a location or manner in which no contamination by droplets or aerosols (sneezing, coughing, talking) can occur (i.e. in another room or closed cabinet).

Of course, hand hygiene of employees is essential in limiting contact infections and the general rule specified in the hospitality industry guidelines (washing hands every half hour) must be supplemented with the following moments
- before preparing food
- before emptying the dishwasher
- Before setting the tables and serving the food (hand-plate contact)

Scenario 4b: Droplet and aerosol formation when manually pre-washing the dishes

Based on the assumptions mentioned above, the risk of exposure via this route is higher than the risk of exposure to droplets (and aerosol) that are formed when rinsing glasses (scenario 1). Due to the lack of sufficient quantitative data, it is not possible, at present, to estimate droplet exposure while manually rinsing dishes, but, on the basis of the above information, exposure cannot be excluded.

Food itself can also be contaminated by droplets through talking and exhalation by asymptomatic excreters, including hospitality industry personnel, and possibly lead to infections. This route has not yet been reported as such and is not part of the explicit questions asked by NVWA, but food exposure is not substantially different from hand-mouth contact in this scenario. If desired, the risk of this route can be reduced through the use of surgical masks by employees to prevent food contamination, and in the long run possibly through daily screening for excretion of SARS-CoV-2 by food processors and serving employees. At present, the use of mouth-nose protection by non-healthcare personnel, or screening of asymptomatic people, is not recommended by the RIVM (https://www.rivm.nl/).

Conclusion

The exact risk of transmission of SARS-CoV-2 from a COVID-19 infected person to a healthy consumer 1.5 metres away has not yet been quantified. It is therefore not

possible to estimate whether other possible transmission routes cause a higher risk of transmission than that of transmission at 1.5 metres. Any additional potential transmission routes have been mapped out, and the transmission potential has been estimated. The main conclusions are described below:

1) Exposure to SARS-CoV-2 by drinking from a rinsed glass that has been used by a person infected with SARS-CoV-2 is a real possibility. The risk of exposure through this route can be reduced by adding an additional step to the glass rinsing procedure (cleaning the rim of the glass with alcohol) or washing glasses in a dishwasher.

   The risk that an infected person visits a hospitality industry facility (and infects glasses) depends on the number of visitors in such a location and the prevalence of the virus: at this time, that risk is limited for each location in itself, but with >60,000 locations, it is potentially a relevant factor in the transmission.
   Note: In Germany, the first post-lockdown COVID-19 restaurant outbreak has already been reported: https://www.dw.com/en/german-covid-19-outbreak-traced-to-restaurant/a-53547360. The failure to follow the general guidelines is considered as a cause.

2) The low number of viruses entering the rinse water, the dilution in the rinse water and the inactivation of the virus by the soap solution present in the rinse water make the risk of droplet transmission via this route so small that no additional measures are recommended.

3) These concentrations of infectious SARS-CoV-2 in rinse water are so low that the risk of exposure while drinking from a glass contaminated by cross contamination through the rinse water is negligible.

4) The likelihood of infectious virus on plates and cutlery that have been washed in a dishwasher is very low, so using plates and cutlery from the dishwasher does not lead to an additional risk. However, it is essential to avoid contamination of plates and cutlery after washing to minimise the possibility of transmission. Additional measures should be taken for this purpose.

For a picture of the extent of SARS-CoV-2 infected hospitality industry visitors, it has been estimated, from RIVM data of 26 May 2020, that at that time in the Netherlands 1:1000 to 1:10,000 people are asymptomatically infected with SARS-CoV-2. This means that in groups of up to 30 people, the risk that someone is infected is < 3%. This patron may be able to infect other persons if they do not observe 1.5 metre distancing rules, or via contaminated glasses, plates or cutlery, where the risk of transmission of the virus is greatest if (insufficiently) rinsed glasses are reused.

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Annex 1. SARS-CoV-2 inactivation by beer glass cleaner

Introduction

To determine whether droplets and aerosols from the rinse sink could lead to SARS-CoV-2 transmission or whether glasses may be cross contaminated after being washed in the sink, an experiment was carried out to determine the effectiveness of water and beer glass cleaner in reducing virus infectivity.

Materials and methods

For this purpose, 2 SARS-CoV-2 virus isolates were diluted in water by a factor of 10; after which 0.5*, 1* and 4* the prescribed concentration of beer glass cleaner was added to the water (Horeca Select, 15-30% anionogenic surface active agents, <5% non-ionic surface active substances, sodium benzoate, potassium sorbate). The prescribed concentration is 5 mL of beer glass cleaner per 10 litres of water. The SARS-CoV-2 isolates were exposed to the various beer glass cleaner concentrations at room temperature for up to 2 hours.

Results

The titres found after the different exposure times and concentrations are shown in Figures 1a and 1b.

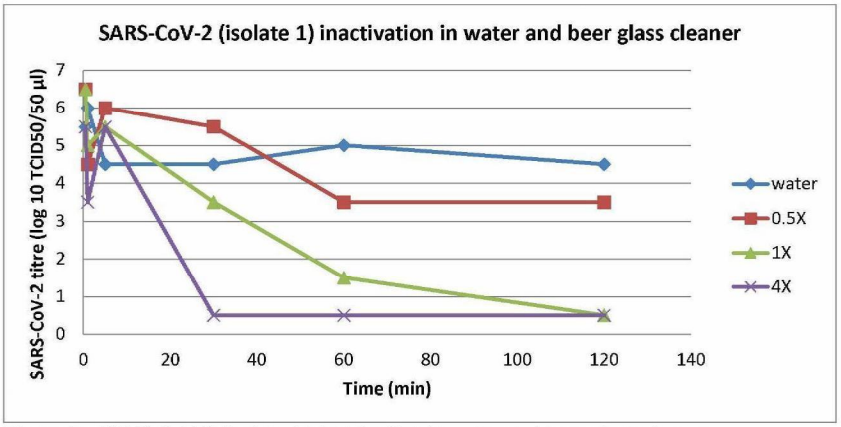

Figure 1a. SARS-CoV-2 (isolate 1) inactivation in water and beer glass cleaner.

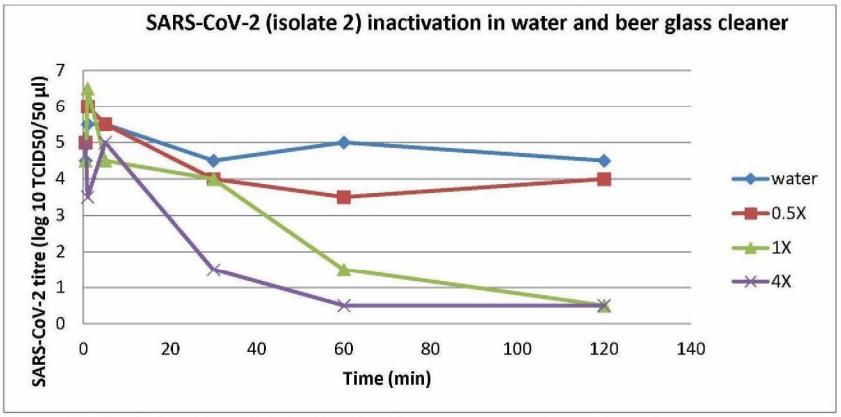

Figure 1a. SARS-CoV-2 (isolate 1) inactivation in water and beer glass cleaner.

Both SARS-CoV-2 isolates show a concentration and time-dependent inactivation of SARS-CoV-2. The detection limit is 1Log10 TCID50/50 µL: the figure shows the points at which no infectious virus was found as 0.5log10 TCID50/50 µL.

Conclusion

When using the prescribed concentration of beer glass cleaner, it takes half an hour at room temperature for an infectious virus reduction to 1-10% of the original contamination to take place. Inactivation is time- and dose-dependent: at higher concentrations, inactivation will occur more quickly, while it will take longer at lower concentrations. Shorter exposure results in less inactivation and longer exposure in more inactivation. It is therefore important to keep the concentration of beer glass cleaner at the prescribed level.