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SARS-CoV-2 inactivation testing: interim report

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Undertaken by High Containment Microbiology, NIS Laboratories, National Infection Service, Public Health England N.B. This is an interim report and may be updated as further results are obtained	

Product/treatment details	
Product/treatment	Buffer RLT + 1% β-mercaptoethanol
Manufacturer	Qiagen
Product code	79216
Composition of product, as supplied	30-50% Guanidinium thiocyanate
Manufacturer's recommended ratio of sample to product	Tissue to be homogenised directly in product

Sample details	
Sample type tested	Ferret lung tissue homogenate
Virus strain tested	SARS-CoV-2 England 2
Ratio of spiked virus stock to sample matrix	1 volume virus to 9 volumes tissue homogenate

Experimental conditions	
Ratio of sample to product tested	Tissue homogenised directly in product
Contact times	10 minutes (following addition of virus to RLT homogenate)
Temperature of incubation	Room temperature

Brief description of tests performed	Triplicate samples were treated with test buffer for indicated contact time/s or mock-treated in triplicate with an equivalent volume of PBS. All samples were then subjected to a purification step to remove cytotoxic buffer components. PBS-treated samples were subjected to the same purification procedure in parallel. **Test 1:** Purified samples were immediately titrated on Vero E6 cells to establish virus titre. This test is quantitative and reports the titre of virus in each treatment condition in TCID50 per ml. Reduction in virus titre following treatment is given as the difference between the mean $\log_{10}$ TCID50/ml for treated conditions and the PBS control. **Test 2:** In parallel, purified samples were seeded onto Vero E6 monolayers to amplify any remaining virus over the course of up to four serial passages. Virus amplification over each passage was detected by visual (microscopic) examination of monolayers for cytopathic effect, and confirmed by SARS-CoV-2-specific real-time PCR. This test is qualitative and reports either the presence or absence of virus amplification. This test may detect levels of virus that are below the detection limit of the titration assay (test 1) due to a greater sample plating volume and the opportunity for any virus present to amplify over serial passages.

Table of results			
Maximum detectable virus reduction in test (log_{10} TCID50/ml)			4.8*
	Test 1: Virus titration post-treatment		**Test 2: Passage of samples in cell culture**
	Mean virus titre (log_{10} TCID50/ml)	Titre reduction (log_{10} TCID50/ml)	Virus detected/ Virus not detected
Virus-spiked PBS	6.5	-	Virus detected (all replicates)
Virus-spiked RLT homogenate	≤1.7*	≥4.8*	Virus not detected

* Virus titre in undiluted sample could not be determined due to cytotoxicity of tissue homogenate

Interpretation

Test 1: RLT + 1% β-mercaptoethanol resulted in a 4.8 log_{10} reduction in infectious virus titre, the maximum detectable virus reduction in this test. The tissue homogenate used in this experiment exhibited some cytotoxicity when plated onto Vero E6 cells; as a result, the virus titre in undiluted sample could not be determined and the maximum detectable titre reduction of the test was reduced.

Test 2: No infectious virus was detected from treated samples after four serial passages in cell culture.

This test was performed with a 10 minute contact time, started after the addition of virus to the RLT tissue homogenate. In practice, it is likely the virus would be in contact with the buffer for a much longer period as infected tissue will have been homogenised directly in the buffer.

Demonstrating complete inactivation is dependent on the starting titre of virus used for testing, and sample treatments that inactivate virus effectively in our testing may fail to inactivate samples containing higher levels of virus than those evaluated in this study.

These tests have been performed using lung tissue homogenate. The effectiveness of this treatment against SARS-CoV-2 may vary when used to inactivate clinical samples or other types of sample matrix. Any results of inactivation testing using other sample matrices will be released as they become available.

Inactivation reagents should not be assumed to be 100% effective against SARS-CoV-2.

Suitability of products and treatments for inactivation of other pathogens has not been evaluated in this study.

All COVID-19 laboratory testing workflows must be subjected to suitable and sufficient risk assessment, with consideration given to any inactivation step. Risk assessments should be reviewed regularly as new information on the inactivation of SARS-CoV-2 becomes available.

The impact of chosen inactivation method on the sensitivity of subsequent SARS-CoV-2 detection should also be assessed locally.

Disclaimer

Summary of revisions	
Version 1:	New document
Version 2:	Header and disclaimer edited; date issued to PHE's COVID Incident Virology Cell added; key guidance points added to interpretation; results and interpretation updated to include recent data.
Version 3:	Reformatted for publication

Queries regarding this report or HCM inactivation testing should be directed to HCMgroup@phe.gov.uk

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