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SARS-CoV-2 inactivation testing: interim report

Report identifier	HCM/CoV2/018/v2
Report date	15 June 2020
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 AVL followed by addition of absolute ethanol (as per Qiagen QIAamp Viral RNA Mini Kit instructions)
Manufacturer	Qiagen (Buffer AVL)
Product code	19073 (Buffer AVL)
Composition of product, as supplied	50-70% Guanidinium thiocyanate Absolute ethanol
Manufacturer's recommended ratio of sample to product	1 volume sample: 4 volumes Buffer AVL: 4 volumes absolute ethanol

Sample details	
Sample type tested	Tissue culture fluid containing 5% (v/v) foetal calf serum
Virus strain tested	SARS-CoV-2 England 2
Ratio of spiked virus stock to sample matrix	Not applicable; tissue culture fluid used undiluted

Experimental conditions	
Ratio of sample to product tested	1 volume sample: 4 volumes Buffer AVL: 4 volumes absolute ethanol
Contact times	10 minutes Buffer AVL treatment followed by addition of absolute ethanol

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 .

Table of results			
Maximum detectable virus reduction in test (log_{10} TCID50/ml)			5.9
	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
PBS-treated	6.8	-	Virus detected (all replicates)
Buffer AVL and ethanol-treated	≤0.8	≥5.9	Virus not detected

Interpretation

Test 1: Treatment with Buffer AVL for 10 minutes followed by addition of absolute ethanol resulted in a ≥5.9 log_{10} reduction in infectious titre, the maximum detectable titre reduction in this test.

Test 2: Infectious virus has not been detected following four serial passages in cell culture.

We have previously demonstrated that treatment with Buffer AVL alone reduced SARS-CoV-2 titre by ≥5 log_{10} but infectious virus could be recovered from all sample replicates in both test 1 and test 2 (Interim Report HCM/CoV2/012).

The addition of ethanol to AVL-treated samples is a required step in viral RNA purification using the Qiagen QIAamp Viral RNA Mini Kit

Demonstrating complete inactivation is dependent on the starting titre of virus used for testing. 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 on tissue culture fluid containing 5% (v/v) foetal calf serum. 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.

Summary of revisions

Version 1: New document
Version 2: Reformatted for publication

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

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