Inactivation of SARS-CoV-2 in samples collected using Oragene®, ORAcollect® and OMNIgene® products from DNA Genotek™

DNA Genotek is a manufacturer of reliable and easy-to-use kits for the collection and stabilization of nucleic acids from biological samples. The popularity of DNA Genotek's products for collecting nucleic acid samples, even from remote parts of the world, has led some researchers and clinicians to enquire about whether there is cause for concern about the possibility that SARS-CoV-2 (the coronavirus that causes COVID-19), if present in some samples, would remain infective.

The following discussion summarizes data available on the topic and our current understanding of (i) the likelihood that the virus, even if present in the original samples, would remain infective once mixed with the chemistry and (ii) shipping regulations that govern these biological samples. This discussion does not address the need for surface decontamination of the outside of the collection device.

Inactivation of SARS-CoV-2 virus by the stabilizing solutions contained in DNA Genotek products

DNA Genotek recently conducted a study to demonstrate the ability of the stabilizing solutions contained in the Oragene® (DNA, RNA, ONE, DISCOVER and Dx), ORAcollect® (DNA and RNA), OMNIgene®•ORAL and OMNIgene®•GUT products to inactivate the SARS-CoV-2 virus.

Briefly, PBS or saliva/stool (confirmed SARS-CoV-2 negative) collected from healthy subjects was spiked with a known quantity of infective SARS-CoV-2 virus. Aliquots of the spiked PBS, saliva or stool were added to DNA Genotek collection devices where they were mixed with the stabilizing solutions. Non-spiked PBS, saliva or stool were used as negative controls and spiked PBS (no stabilizing solution) was used as a positive control. Infective virus remaining in each sample was quantified in Vero E6 cell culture using an endpoint dilution assay and the TCID50/mL calculated using the Reed-Muench method.

When virus-spiked PBS or saliva/stool was mixed with each of the stabilizing solutions tested, a >99% reduction in infective virus in the sample was observed. Additionally, there was no observable difference between the virus-free negative controls and the test samples collected into DNA Genotek sample collection kits. (Figure 1).

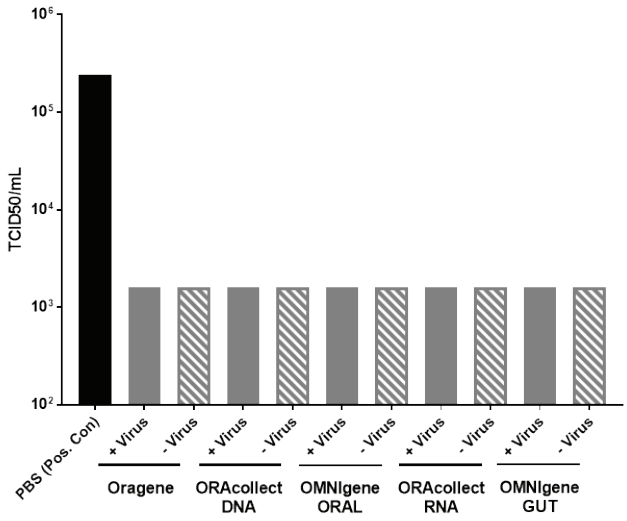

Figure 1: Quantification of infective SARS-CoV-2 in virus-spiked, untreated PBS (positive control) and virus-spiked PBS mixed with preservative solutions found in various DNA Genotek saliva and stool collection kits ("+ virus"). Unspiked PBS mixed with preservative solutions were used as negative controls ("- virus"). All preservative solutions tested reduced the viral titer to the same level as the negative controls (>99% inactivation).

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The observations in this study are supported by other studies. For example, a recent study conducted at SUNY Upstate Medical University (Syracuse, NY) observed complete viral inactivation of Zika virus by the stabilizing solution in ORAcollect•RNA within 15 minutes of sample treatment (personal communication, Figure 2).

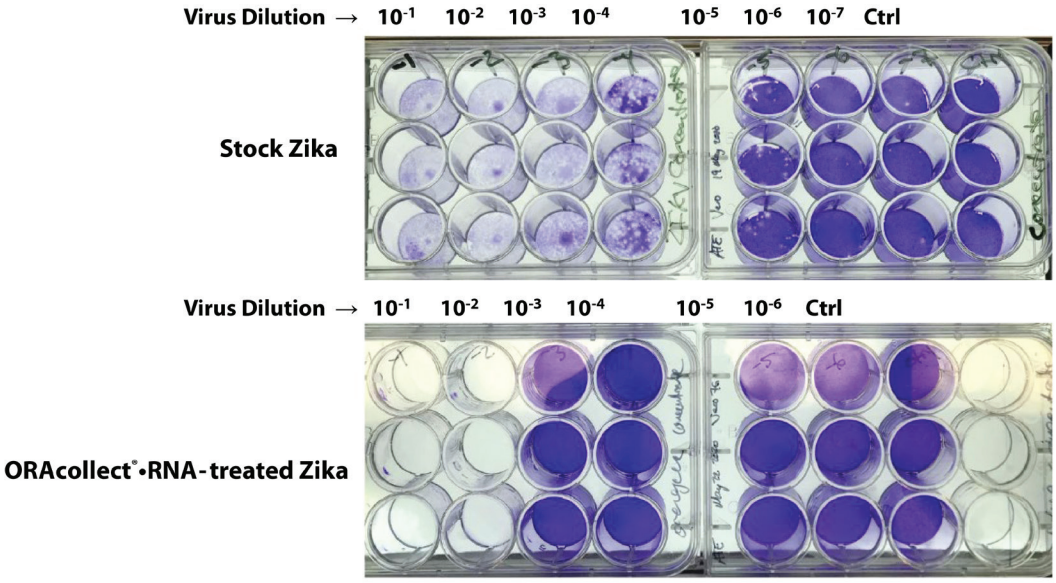

Figure 2: Plaque assay of ORAcollect•RNA-treated Zika virus. Virus-induced plaque formation is clearly visible in the untreated wells across multiple viral concentrations (upper panel) while no plaque formation is visible in the ORAcollect-treated samples (lower panel). Notably, the Vero cells actually experienced complete cell death due to the ORAcollect reagent carryover in the highest concentrated samples (clear wells on left of lower panel).

In addition to studies directly testing the ability of DNA Genotek products to inactivate viruses, there is significant literature indicating that certain components found in the stabilizing solutions are able to completely inactivate enveloped viruses including SARS-CoV (the virus that causes Severe Acute Respiratory Syndrome) or MERS-CoV (causes Middle East Respiratory Syndrome), both of which have similarity to SARS-CoV-2[1,2]. Methods to inactivate enveloped viruses of this type have been extensively studied and it has been shown that the lipid envelope (outer layer) of these viruses is very susceptible to treatment with detergents and mild solvents[3,4]. The stabilizing chemistries contained in products in the Oragene, ORAcollect and OMNIgene product families contain an ionic detergent which is expected to render enveloped viruses non-infective[5,6].

SARS-CoV and MERS-CoV are also sensitive to heat treatment. A number of studies have shown that heat treatment of coronavirus at temperatures ranging from 56°C to 68°C over a period of time ranging from 10 to 60 minutes is effective at inactivating the virus particles[4,7,8] and that the time required to obtain complete viral inactivation decreases with increased temperature[9]. Although the data presented above indicate that DNA Genotek's stabilizing solutions inactivate the SARS-CoV-2 virus without requiring an additional inactivation steps, in the event that samples are being collected from individuals suspected of being infected or are obtained from areas considered high risk, and if the researcher deems that further precautions are warranted, samples may be incubated in their original vials at elevated temperatures as indicated in previously mentioned publications. It is the responsibility of researchers and clinicians to determine whether this additional precaution is required, based on local circumstances and applicable regulations.

Shipping biological samples collected using Oragene, ORAcollect and OMNIgene kits:

Packaging, shipping, and transport of specimens must follow the current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations[10].

Follow shipping regulations for UN 3373 Biological Substance, Category B when sending potentially infective specimens (IATA DGR Section 3.6.2.2.2.2).

Follow regulations for "Exempt Human Specimens" for samples not expected to be infective (IATA DGR Section 3.6.2.2.3.8).

In determining whether a patient specimen has a minimal likelihood that a sample is infective, an element of professional judgment is required to determine if a biological sample is exempt under the regulations applicable in your jurisdiction. That judgment should be based on the known medical history, symptoms and individual circumstances of the source, human or animal, and endemic local conditions, as well as available data.

References

1 Coronaviridae Study Group of the International Committee on Taxonomy of Viruses. The Species Severe Acute Respiratory Syndrome-Related Coronavirus: Classifying 2019-nCoV and Naming It SARS-CoV-2. *Nat Microbiol.* Mar 2 2020 (https://doi.org/10.1038/s41564-020-0695-z).

2 Lai C et al. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *Int J Microb Agents.* Feb 20 2020 (https://doi.org/10.1016/j.ijantimicag.2020.105924).

3 Rabenau HF et al. SARS-coronavirus (SARS-CoV) and the safety of a solvent/detergent (S/D) treated immunoglobulin preparation. *Biologicals.* 33(2):95-99 (2005).

4 Darnell MER et al. Evaluation of Inactivation Methods for Severe Acute Respiratory Syndrome Coronavirus in Noncellular Blood Products. *Transfusion.* 46(10), 1770-7 (2006).

5 Howett, MK et al. A Broad-Spectrum Microbicide with Virucidal Activity against Sexually-Transmitted Viruses. *Antimicrob Agents Chem.* 43(2):314-321 (1999).

6 Piret, J et al. Sodium Lauryl Sulfate, a Microbicide Effective Against Enveloped and Nonenveloped Viruses. *Curr Drug Targets.* 3(1):17-30 (2002).

7 Rabenau HF et al. Stability and inactivation of SARS coronavirus. *Med Microbiol Immunol.* 194:1-6 (2005).

8 Kariwa H et al. Inactivation of SARS coronavirus by means of povidone-iodine, physical conditions, and chemical reagents. *Jpn J Vet Res.* 52(3):105-112 (2004).

9 Paget A et al. Evaluation of SARS-Coronavirus Decontamination Procedures. *Applied Biosafety.* 12(2):100-8 (2007).

10 International Air Transport Association Dangerous Goods Regulations, 60th Edition. (2019).