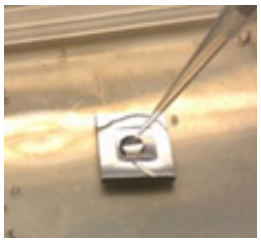
UVC exposure effect on SARS-COV-2 cDNA inactivation using the UVC reflecting (UVCr) coating

Author: Vasily Bankovsky

Medical–Biological Research & Technologies



Abstract

In this article we show the UVC exposure effect on SARS-COV-2 cDNA inactivation using the UVC reflecting (UVCr) coating inside UV air recirculator, UVR-M (Biosan, Latvia. Our work consists of the following parts:

- The development of sampling method
- The effect of the UVC dosage on the different concentration of the sample placed on the UVCr surface
- The comparison between UVC light reflectivity between UVCr coating and polished aluminium

The development of sampling method

As the target sample, the Positive control from Sars-Cov-2 RT-PCR kit (Vector-Best, Russia) was chosen. PC control target sequence is not disclosed.

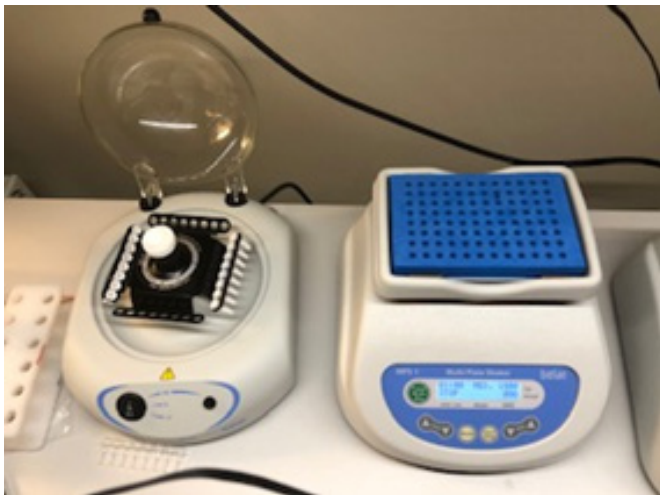
The sampling was performed in the PCR cabinet UVC/T-AR (Biosan, Latvia). Special sampling holders with UVCr coating were made. The holders were sterilized in the cabinet with UVC light for 10 minutes before being used.

For the dosage experiments the samples were placed under prewarmed germicidal recirculator (UVR-M) for 0, 5 and 10 seconds at distance of 11 mm from the lamp. The UVC dosage is calculated to be 0, 55 and 110 mJ/cm^2

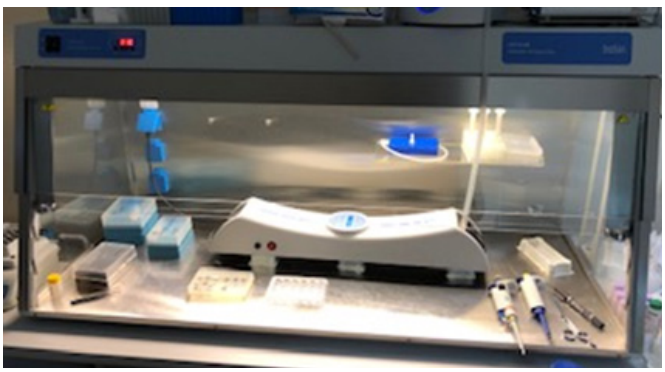
The samples were taken using mechanical pipette and transferred to an Eppendorf tube.

The sample preparation and amplification steps were carried out according to the PCR kit's protocol.

The sample isolation was carried out using on MPS-1 (Biosan, Latvia) mini shaker and on centrifuge-vortex FVL-2400N with Rotor S-32 (Biosan, Latvia).



The Real time PCR was carried out on Bioquant (Biosan Latvia).

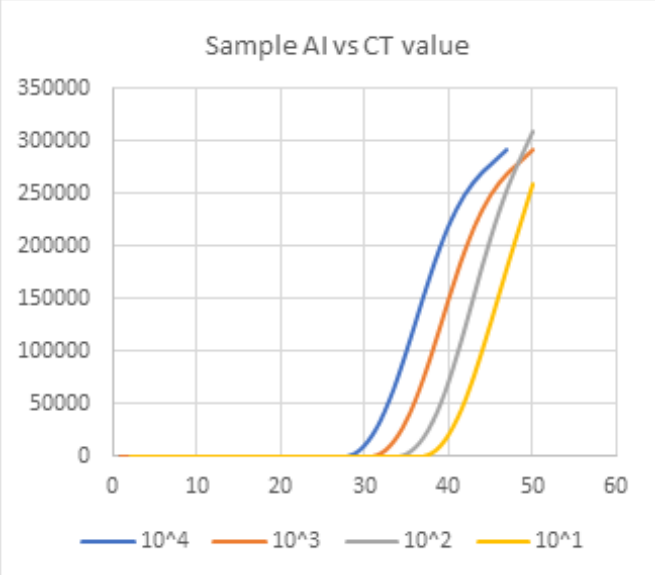


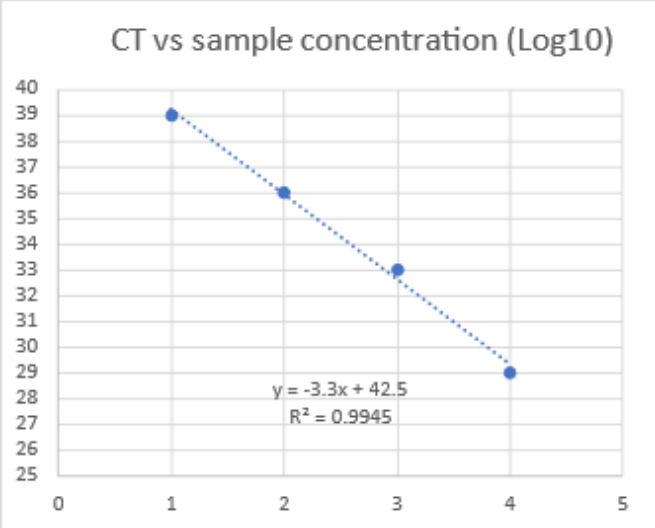
Statistical accuracy

Since the method developed by us assumes the adsorption of cDNA on the substrate surface with subsequent exposure to UVC and resorption, a statistical assessment was made of the reproducibility of the technique for 10 samples with the same cDNA concentration. The results indicate that the method has high reproducibility with a standard deviation of 0.17 Ct averaging at 34.7 Ct.

Finding optimal cDNA concentration range

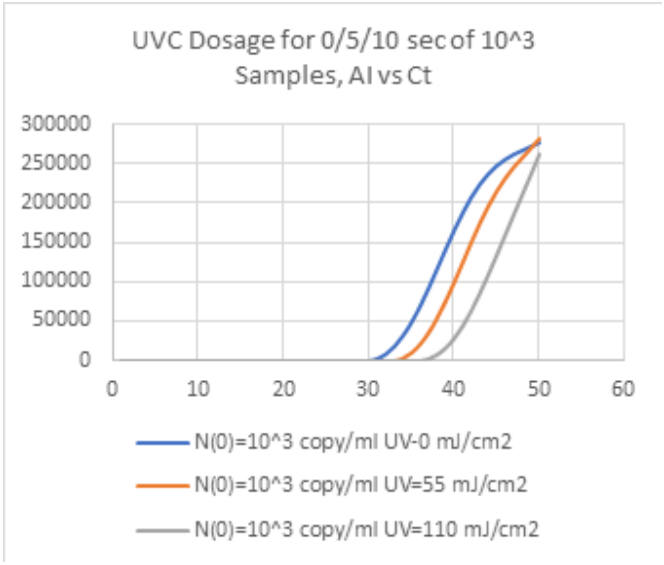
It was determined that the sample concentration is to be linear between 10 and 1000 copies per ml.

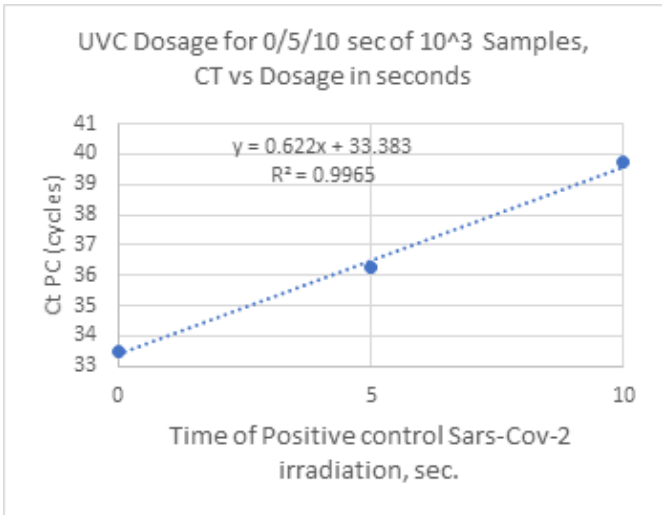




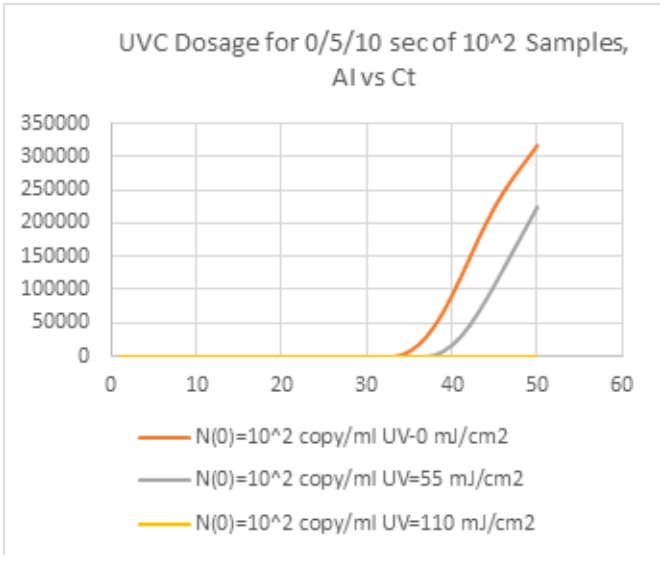
UVC dosage effect on different concentration

Samples with 10^3 and 10^2 copies/ml concentration were selected as main targets.





The graph shows the linearity of the growth of the Ct value of the samples versus the UVC dose.



The graph shows that with the concentration of 100 copies/ml cDNA, the dose above 55 mJ/cm^2 provides 100% inactivation of the target cDNA.

UVC light reflectivity comparison between surface coatings

The comparison between the UVC light reflectivity between the polished aluminium and the UVCr surface was measured with ST-512, UV-Light Meter (Sentry, Taiwan R.O.C.), which showed that UVCr results a twice greater value than polished aluminium surface: 4 mW vs 2 mW at distance of 70 mm. From this we can assume that the UVCr coating provides twice more efficient germicidal effect.

Comparison picture of reflectivity between polished aluminium surface vs UVCr coated surface

Conclusions

Based on the data, we can conclude on the importance of the coating of the internal chamber of the UV air recirculator UVR-M. UVC reflecting coating should be used to maximize the germicidal effect of the device.

Also, we have learnt that the concentration of viral cDNA sampled on the surface should be also taken into the account in regards to the required radiation dose needed for the complete inactivation of the viral DNA/RNA molecule.

At a distance of 11 mm from the UV lamp (inner surface of the recirculator) for 5 seconds, the UV dose is 55 mJ / cm^2, and at a distance of 2 mm, 75 mJ / cm^2 (36% higher). Consequently, given the non-laminar air movement through the inner chamber, the real efficiency is probably higher than the obtained values.

Stay tuned for more experiments and the discussion part, which are work in progress.