Application Note

Decontamination procedure using the UV LED source from QIAcube® Connect

Introduction

Automation of QIAGEN® spin-column kits using the QIAcube Connect instrument, saves time and ensures standardized results. The instrument design and high grade of automation reduces contamination risk during liquid handling. However, during sample preparation, low levels of aerosols may form or some of the sample may spill on the worktable by accident. Here we describe how the use of the onboard UV light in the QIAcube Connect instrument, in addition to the normal maintenance procedure of cleaning and wiping the worktable, helps achieve better whole instrument decontamination. The term decontamination refers to irreversibly inactivated non-amplifiable DNA, as well as deactivated nucleic acids or inactivated pathogens, through UV light exposure. The efficiency of the UV light exposure on both, the worktable and centrifuge, are assessed here.

Materials and Methods

Genomic DNA (gDNA) was isolated from 1x10e7 Jurkat cells using the QIAamp® DNA Mini Kit, fully automated on the QIAcube Connect, according to the respective kit manual. Quantification of the DNA was performed using QIAGEN's QIAxpert® (data not shown). Based on the quantification, a serial dilution was generated resulting in 5 ng/µl, 0.5 ng/µl and 0.05 ng/µl of genomic DNA. For the UV light performance test, 20 µl of each dilution was spotted on the worktable and in centrifuge buckets with a final gDNA amount of 100 ng, 10 ng or 1 ng per drop. The spots were air-dried overnight. The dried spots were treated as summarized in Table 1.

The UV light exposure was performed using the QIAcube Connect UV LED light protocol (1 cycle, 12 minutes). Prior UV light exposure selected spots were treated using the daily cleaning procedure according to the manual (from here on referred to as "wiping"). For DNA recovery, 20 µl of nuclease-free water was pipetted onto the dried spots for rehydration, and incubated for 10–15 minutes to re-dissolve the dried DNA. ▷

Drops were pipetted into 0.5 ml PCR-reaction vessels and stored at –20°C until further use. Quantitative real-time PCR (qPCR) was performed on these samples using a QIAGEN Probe PCR kit according to the respective kit manual, and a probe assay for gDNA detection.

Table 1. Treatment of DNA spots

Sample	Description	Treatment
PosCTRL	Positive control	Covered with aluminum foil to avoid UV light exposure
UV test	UV light test	Fully exposed to UV light to deactivate nucleic acids (e.g., formation of thymine dimers)
Wipe+UV	Wipe and UV light	Cleaned by wiping, then fully exposed to UV light
Wipe only	Wipe and clean only	Cleaned by wiping, then covered with aluminum foil
NegCTRL	No gDNA	Only buffers without gDNA used to show that there is no nucleic acid contamination in the buffers used

Results

UV light is utilized in many devices or systems for biological applications, such as cell culture or PCR to decontaminate and deactivate microbes, viruses, enzymes or nucleic acids. An option to use UV light for decontamination is now also available in the QIAcube Connect. The main goal of the described tests was to measure the efficiency with regards to DNA inactivation (no longer amplifiable), upon exposure to UV light. In Figure 1, the DNA deactivation after 12 minutes (1 UV light cycle) of UV light exposure in the QIAcube Connect is shown for the three different gDNA amounts. A 1000-fold decrease of amplifiable gDNA was achieved after this time. On the worktable, the positive control with 100 ng gDNA shows a Cq value of 23, while the same amount of gDNA exposed to UV light for 12 minutes showed a Cq value of 32. Lower amounts of gDNA (10 ng and 1 ng) were not detectable at all. A similar result was obtained when analyzing the centrifuge buckets – 100 ng gDNA covered with aluminum foil (= positive control) gave a value of 24 Cq, while 100 ng gDNA was barely detectable with a Cq of 32, after UV light exposure. When the wipe and clean procedure was performed, with or without subsequent UV light exposure, gDNA was not detected, independent of the location of the spots (on the worktable or inside the centrifuge buckets).

These results demonstrate that the UV light protocol of the QIAcube Connect is a highly efficient method for decontamination. When combining wiping and UV light exposure, not only can removal of contamination for the worktable be achieved, but also deactivation of aerosols and decontamination of DNA on worktable areas that are difficult to access with wiping. This ensures highly efficient decontamination of the whole instrument, and peace of mind for subsequent sample preparation.

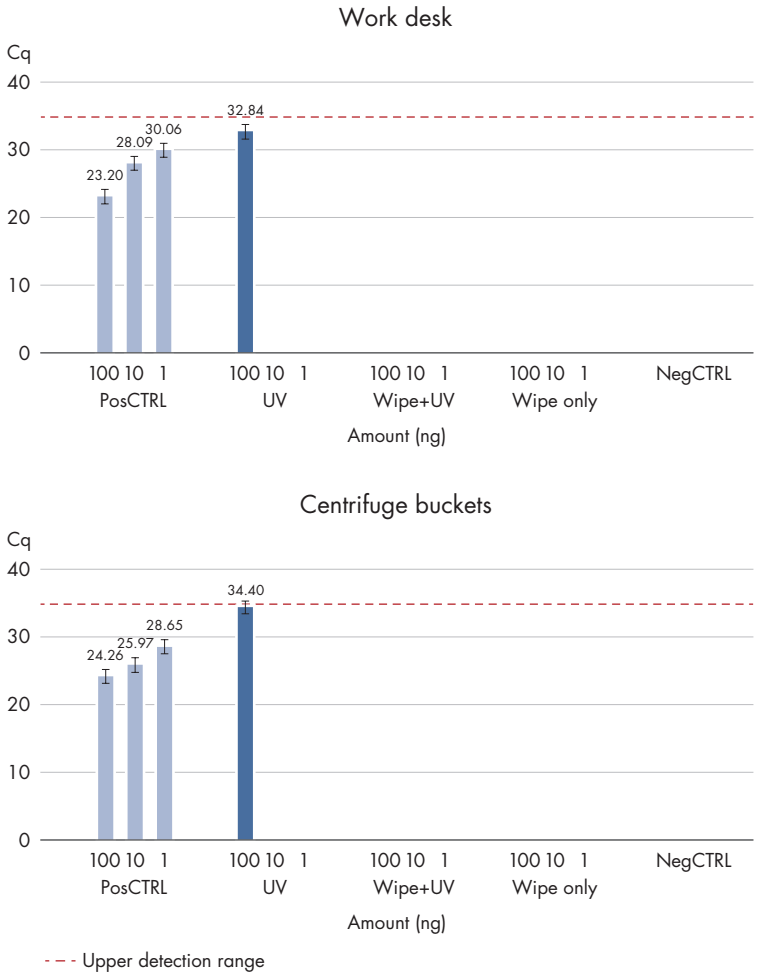

Figure 1. Plot of quantification cycles of amplifiable, therefore detectable, gDNA after different cleaning procedures. Genomic DNA is barely (100 ng, a 1000-fold reduction compared to PosCTRL) or not (10 ng and 1 ng) detectable anymore when exposed to UV light alone (without any wipe and cleaning procedure). When a wiping and cleaning protocol is also applied, no DNA can be detected.

Conclusion

- A deactivation of at least 1000-fold of amplifiable gDNA can be achieved with the decontamination procedure on the QIAcube Connect, using just one cycle of UV light (~12 min)
- The power of the UV light ensure a decontamination of 99.99% of *E. coli* within just two cycles of UV light (~24 min)
- If required, an overnight UV run can also be performed to ensure decontamination from persistent pathogens for daily maintenance, without losing irradiation power due to long-life LED UV light
- The use of UV light is an efficient method to decontaminate whole instruments, especially for areas that are hard to reach only by wiping (including aerosols)

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1115522 11/2018