Some Thoughts on a Standard Protocol for Validating UV Disinfection Units for Surface Disinfection

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In the articles that have been submitted for this issue of *IUVA News*, there are attempts to move toward the establishment of a standard test protocol for validating UV devices intended for the UV disinfection of surfaces. As the special editor of this issue, I decided to try to help the process with some thoughts derived from my experience with the validation of UV devices intended for the UV disinfection of drinking water or wastewater.

In my view, any standard protocol for validating UV disinfection units for surface disinfection should be based on biodosimetry, as are the protocols for validating UV disinfection units for the disinfection of drinking water and wastewater (e.g., the US-EPA Long Term 2 Enhanced Surface Water Regulation (EPA 2006a) and the Ultraviolet Disinfection Guidance Manual (UVDGM) (EPA 2006b), the Austrian ÖNORM Regulations (ÖNORM 2001, 2006) and the German DVGW Regulations (DVGW 2006).

Biodosimetry means challenging the device with a standard microorganism and comparing the viable counts with and without UV exposure. The log inactivation [$\log(N_0/N]$, where N_0 is the count level with no UV exposure and N is the count level with UV exposure, is determined for a range of UV exposures.

In a separate experiment, the UV sensitivity of the standard microorganism is determined from a UV dose-response curve, from which one can determine the UV dose applied for each exposure. If one tries to apply this approach to the UV disinfection of a surface, the procedure might be:

1. Define a standard surface, which should have some relevance to a practical application – the standard surface might be a geometric pattern of grooved metal pieces, so the surface has some texture
2. Apply a fixed number of cells to each of the standard surface metal pieces
3. Install the UV device according to the manufacturer's instructions
4. Turn on the UV device and allow it to warm up
5. Expose the standard surface to UV from the UV device for a fixed number of seconds (best to use a shutter)
6. Extract the cells quantitatively from the surface pieces and determine the number of viable cells (N) in each piece
7. Repeat steps two through six for several different exposure times
8. Intersperse repeats of steps two through six for zero exposure; here the counts would be N_0
9. Calculate the log inactivation [$\log(N_0/N]$
10. In a separate experiment, use a UV device that will generate a known irradiance (mW/cm^2) at each metal piece of the standard surface and thus determine the UV dose-response curve for the standard microorganism
11. Convert the log inactivations to UV doses using the data from step 10

The overall validation testing should be carried out at an established validation center or by a qualified third-party professional following a standard protocol to be developed by IUVA. If government agencies (e.g., USEPA and/or NIST) are involved in the process of writing the protocol and establishing one or more validation centers, all the better. ■

References

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