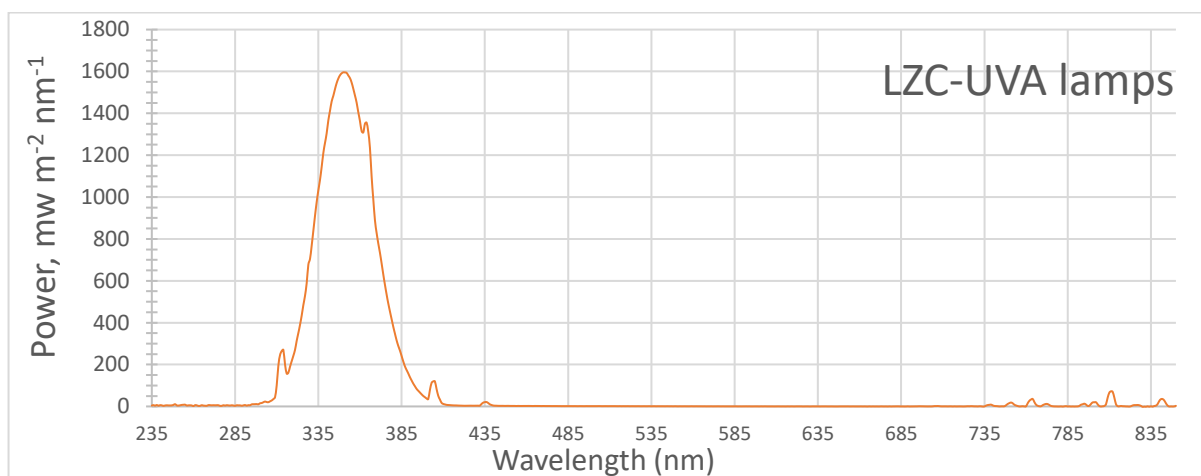


TECHNICAL RELEASE
LUZCHEM EXPOSURE STANDARD: LES-UVA-19

General information: Luzchem Research, Inc. produces and distributes freely these standards as a service to scientists involved in research in photochemistry, photobiology and photostability. These standards are available on Luzchem's website. References to our standards can be used to define conditions of exposure and should allow other scientists to readily replicate irradiation conditions. Luzchem has used a calibrated Luzchem SPR-4001 (s/n 047) spectroradiometer calibrated on June 29, 2017. The SPR-4001 is calibrated using NIST traceable lamps: Spectra Physics Deuterium Lamp (UV) Model 63945 Serial # 667172 Calibrated September 2013, and Spectra Physics Tungsten Halogen Lamp (VIS) Model 63355 Serial #7-1769R2 Recalibrated November 2013 and to the best of our knowledge spectral information is accurate within the experimental bandwidth of 2 nm.

| | | | |
|----------------------|--|----------------------------|--------------------------------|
| Lamp Type | Luzchem LZC-UVA | Internal surface | Unpolished scattering aluminum |
| Filter | None, direct and reflected exposure | Measurement Temperature | 25 °C |
| Filter effect | N/A | Measurement date | November 14, 2017 |
| Photoreactor model | LZC-ICH2 | Monitored range | 235 to 850 nm |
| Number of lamps | 8 overhead lamps, side lamps not used. | Harmonic peak interference | None observed |
| Measurement distance | ~ 18 cm lamp to target | Resolved peaks | 314, 352, 364, 405 nm |



| Region | Range, nm | Dose mw*m ⁻² | % energy |
|---------|-----------|-------------------------|----------|
| UVA | 315-400 | 66,936 | 94.8% |
| UVB | 280-315 | 1,315 | 1.9% |
| UVC | 235-280 | 295 | <1% |
| Visible | 400-700 | 1,097 | 1.6% |
| NIR | 700-850 | 986 | 1.4% |

The table to the left shows the energy distribution at the target, expressed as a percentage of the total energy, and as a percentage of the number of photons. The calculations refer to the monitored range indicated above. The division between UVA and UVB has been taken as 315 nm.

- (1) The same spectral information should also apply to other photoreactors constructed of the same materials, including all of Luzchem models.
- (2) For details of Luzchem's spectra determinations see Technical Release: Recording of Luzchem Exposure Standards.

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