New UV LED Tables

Technical note on Alliance IRIS'
innovative LED Tables technology

Introduction

In the world of imaging systems, precision, efficiency, and sustainability are paramount. Enter the new UV LED Tables of IRIS, a groundbreaking innovation that will rapidly overshadow traditional UV tubes. With international treaties being designed over the last decade to protect human health and the environment from emissions of mercury, for the first time, UV LED will emerge to answer to these international obligations (1).

Imagine an illumination source that offers unparalleled brightness, longer lifespan and significant energy savings, all while being more environmentally conscious (2). This is what UV LED will bring to the table. Unlike their predecessors, UV tubes, that contain not only harmful mercury components but consume more energy, have shorter lifespan, and generate excessive heat, resulting in higher operational costs and frequent maintenance, the new UV LED tables offer superior efficacy and versatility. Here's how:

Energy efficiency

Compared to UV tubes, LEDs convert electricity into UV light more efficiently seeing that UV tubes loss energy during the electrical to light conversion process resulting in poor energy efficiency. An issue that is not observed with UV LED tables that provides on the other hand a lower energy cost and smaller carbon footprint.

DNA damage reduction

LED UV-B lamps emit a peak at a specific wavelength with a precise spectral distribution, minimizing exposure to unnecessary UV light limiting the damage on the DNA within a biological sample **(3).**

Lifespan

With an estimated lifetime of tens of thousands of hours, the UV LEDs last longer than UV tubes preventing the need for frequent replacement and maintenance costs **(2-6).**

Reduced heat

UV-LED generate less heat than UV tubes **(3,7).** Lower temperatures help maintain the integrity of biological samples, ensuring more accurate and reliable results, while also extending the device's operational life.

Faster activation

UV tubes require a warm-up period to reach full UV light emission efficiency, unlike UV LEDs which achieve full luminous intensity instantly, with instant on-off capability **(8).**

Accuracy and consistency of UV exposure

UV LEDs offer greater accuracy and consistency of UV exposure. Their ability to emit specific wavelengths can reduce exposure variations **(3)** and ensure uniform illumination **(5)** of electrophoresis gels, allowing more accurate visualization of bands.

Versatility

Today, UV LED tables will have an individual light source for the different applications needed. Whether it be for Coomassie or Safe Dyes (i.e.; SYBR Safe), a specific LED table (UV, White and Blue), is provided to answer these various domains.

Conclusion

UV-B LED technology offers a significant benefit over traditional UV fluorescent tubes due to their superior energy efficiency, its ability to minimize DNA damage but notably in its capacity to reduce both energy consumption and its carbon footprint.

References

1. Coulter, M. A. Minamata Convention on Mercury. *International Legal Materials,* **55**, 582–616 (2016).
2. Pizzichetti, R., Martin-Gamboa, M., Pablos, C., Reynolds, K., Stanley, S., Dufour, J., Marugan, K., Environmental life cycle assessment of UV-C LEDs vs. mercury lamps and oxidant selection for diclofenac degradation. *Sustainable Materials and Technologies* 41 (2024).
3. Pirc, M., Caserman, S., Ferk, P. & Topič, M. Compact UV LED Lamp with Low Heat Emissions for Biological Research Applications, *Electronics* **8**, 343 (2019).
4. Muramoto, Y., Kimura, M., Dempo, A., Nouda, S. & Fukawa, Y. 66.1: Application of UV-LED to the LCD Backlight*, SID Symposium Digest of Technical Papers* **41**, 982–984 (2010).
5. Miralles-Cuevas, S., Soriano-Molina, P., de la Obra, I., Gualda-Alonso, E. & Pérez, J. A. S. Simultaneous bacterial inactivation and microcontaminant removal by solar photo-Fenton mediated by Fe3+-NTA in WWTP secondary effluents, *Water Res,* 205, 117686 (2021).
6. Silva, N. B., Leonel, L. P. & Tonetti, A. L. UV-LED for Safe Effluent Reuse in Agriculture. *Water Air Soil Pollut*, 231, 343 (2020).
7. Nicolau, T., Gomes Filho, N., Padrão, J. & Zille, A. A Comprehensive Analysis of the UVC LEDs' Applications and Decontamination Capability, *Materials (Basel)* 15, 2854 (2022).
8. Eskandarian, M. R., Ganjkhanloo, M., Rasoulifard, M. H. & Hosseini, S. A. Energy-efficient removal of acid red 14 by UV-LED/persulfate advanced oxidation process: Pulsed irradiation, duty cycle, reaction kinetics, and energy consumption. *Journal of the Taiwan Institute of Chemical Engineers* 127, 129–139 (2021).