Blue/Green LED Technology: a safe and more efficient approach.

The future of gel documentation is now!

Technology	BLUE GREEN BG LED Blue/Green LED Technology
Product	FastGene® FAS-X Gel Documentation System
Manufacturer	NIPPON Genetics EUROPE GmbH

The following data was provided by the manufacturer: NIPPON Genetics EUROPE GmbH

Summary

Blue/Green LED technology is transforming gel documentation by providing a safer, more versatile, and higher-performing alternative to traditional UV and common Blue LED transilluminators. Operating in the safe 470 nm - 520 nm range, this innovative technology eliminates the risks of UV exposure, such as DNA damage and user health hazards, and overcomes the limitations of single-wavelength Blue LED systems by efficiently exciting a wide range of DNA dyes and fluorescent proteins. The FastGene® FAS-X gel documentation system from NIPPON Genetics EUROPE uses this technology, offering unmatched versatility and high-intensity illumination to streamline workflows and ensure reliable, high-quality results while guaranteeing the safety of both samples and users.

Introduction

Gel documentation is a fundamental technique in molecular biology, used to visualize DNA and protein samples. Traditional UV transilluminators have long been the standard despite their associated risks, such as DNA damage and potential harm to users. Common Blue LED transilluminators, operating at a single wavelength of 470 nm, also have significant limitations, often failing to efficiently excite various DNA dyes and resulting in suboptimal visualizations. These challenges highlight the need for safe, more versatile, and effective technologies. The FastGene® FAS-X with Blue/Green LED technology addresses these challenges by offering an advanced system that ensures safety, versatility, and superior performance.

The problems of UV light and Blue LED light

Risks associated with UV transilluminators

UV transilluminators, while effective in exciting certain dyes, operate in a harmful range of the spectrum. This poses significant risks, including:

- DNA damage and mutations
- Degradation of sample integrity
- Skin burns and eye injuries for users

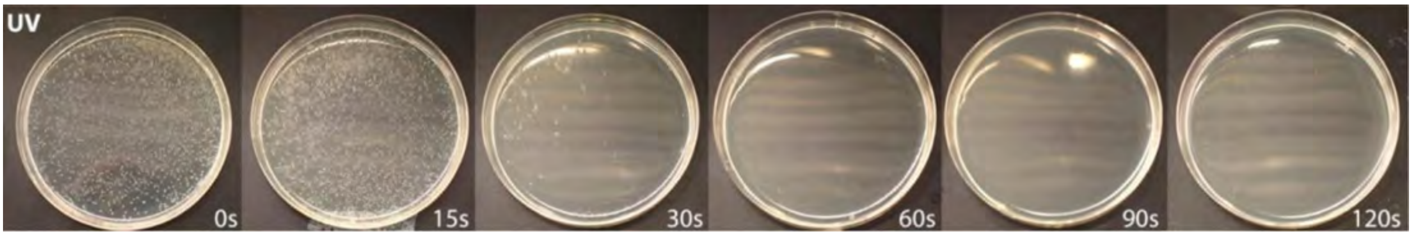


***Figure 1: Bacterial agar plates demonstrating UV-induced DNA damage.** Bacteria were transformed with DNA fragments coding for antibiotic resistance and plated on agar plates containing antibiotics. Prior to transformation, the DNA fragments were exposed to UV light for varying durations (0 to 120 seconds). A significant reduction in bacterial colonies was observed when the DNA was illuminated for just 30 seconds, indicating substantial UV-induced DNA damage.*

UV light is highly energetic and can cause DNA strand breaks, mutations, and thymine dimers. This damage affects the DNA's quality, making it unsuitable for cloning, sequencing, and other applications. Degraded sample integrity means experiments can fail or produce unreliable results.
For users, unprotected UV exposure can cause skin burns, increase the risk of skin cancer, and cause severe eye damage, such as cataracts. Handling these systems requires protective equipment, which complicates laboratory work.

Limitations of common Blue LED transilluminators

Common Blue LED transilluminators, which operate at a single wavelength of 470 nm, also present issues:

- Inefficient excitation of a wide range of DNA dyes
- Poor and unsatisfactory visualization results
- Limited versatility in handling different dyes and fluorescent proteins

Lack of versatility and limited compatibility with fluorescent dyes requires researchers to use multiple devices, complicating workflows and increasing costs.

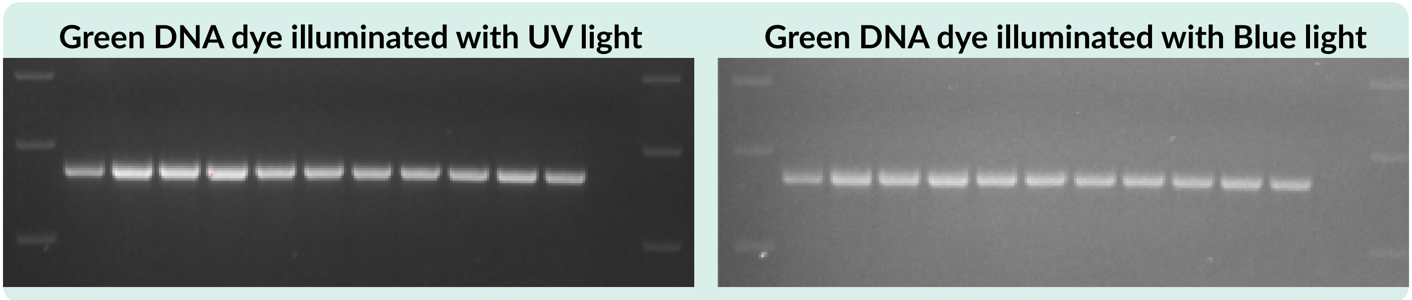


*Figure 2: **Comparison of DNA staining with UV and Blue LED light.** Green DNA dye was illuminated using UV light and Blue LED light. The Blue LED illumination resulted in lower signal intensity and higher background noise, leading to poorer DNA band signal and reduced image quality compared to UV light.*

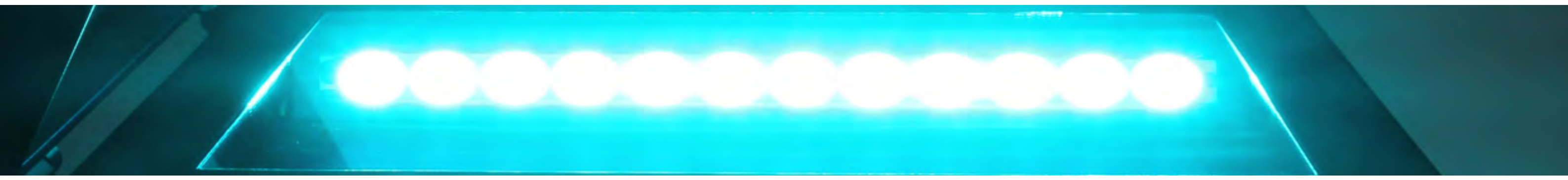
The solution: Blue/Green LED Technology

Total safety for you and your samples

The FastGene® FAS-X leverages Blue/Green LED Technology, emitting light in the safe 470 nm - 520 nm range. This spectrum eliminates the risks associated with UV exposure, ensuring:

- No DNA damage or mutations
- Preservation of sample integrity
- Safe handling without protective gear

With Blue/Green LED technology, samples remain intact and unaffected, ensuring the integrity and reliability of your experimental results. This means you no longer need to worry about UV-induced DNA mutation or degradation, allowing for consistent and accurate analyses.
It also provides a user-friendly experience, easy handling and no need for the protective gear typically required when working with UV light. This not only increases safety, but also improves convenience and efficiency in the laboratory.



Incredible versatility

One of the outstanding advantages of the FastGene® FAS-X is its versatility. The Blue/Green LED Technology is compatible with a wide range of DNA dyes, making it an invaluable tool for any laboratory. Researchers can use green DNA dyes such as MIDORI Green or SYBR Green, yellow dyes such as SYBR Gold or red dyes such as EtBr or GelRed.

However, the Blue/Green LED Technology is not limited to DNA dyes. It also efficiently activates fluorescent protein dyes. This capability provides unparalleled flexibility for multiple applications, ensuring that researchers can rely on a single, efficient system for both DNA and protein gel analysis.

MIDORI^Green Xtra DNA dye | **GelRed® DNA dye** | **SERVA Lightning Red protein dye**

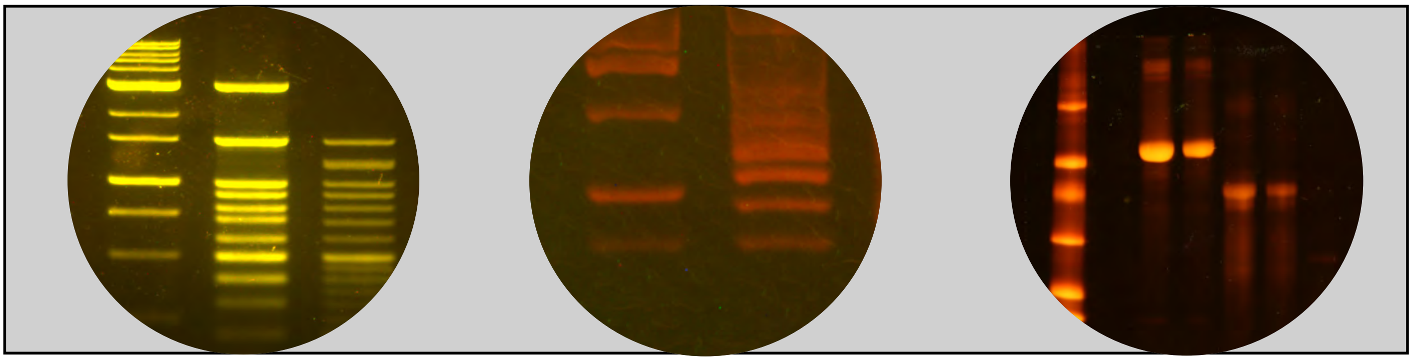


Figure 3: Comparison of different DNA Dyes with Blue/Green LED light. *The first two gels display DNA images stained with MIDORI Green Xtra DNA dye, the second gel with GelRed DNA stain, and the third gel is a protein gel stained with SERVA lighting RED protein stain. All images demonstrate that Blue/Green LEDs can efficiently excite various DNA stains, yielding high signal sensitivity and low background.*

Effective excitation of fluorescence proteins

The Blue/Green LED technology effectively excites fluorescent proteins, such as YFP, RFP, GFP and many more. This capability is particularly beneficial for applications such as visualizing bacterial colonies on plates expressing these proteins. The safe excitation light allows researchers to examine living organisms for fluorescent protein expression without harm. This ensures bright, clear visualizations that improve the accuracy and efficiency of experimental workflows.

GFP | **YFP + RFP**

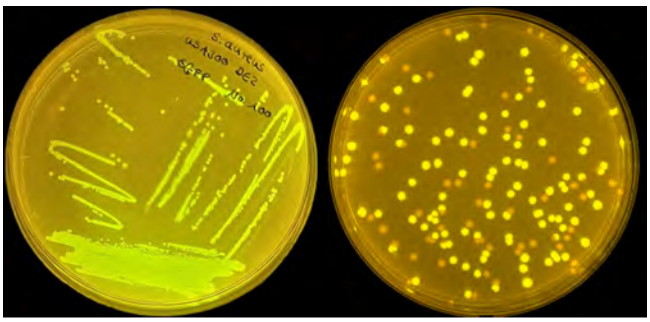


Figure 4: Agar plates with bacterial colonies expressing GFP or YFP + RFP under Blue/Green LED light. *The Blue/Green LED light effectively excites different fluorescent proteins such as GFP (Green Fluorescent Protein) or YFP (Yellow Fluorescent Protein) and RFP (Red Fluorescent Protein), on a single agar plate. This capability facilitates easy differentiation and comparison of the bacterial colonies expressing these proteins.*

Exceptional performance

The high-intensity Blue/Green LED light ensures superior excitation of various dyes, resulting in brighter and clearer images. This enhances the accuracy of analysis and documentation, providing researchers with reliable, high-quality data. The FastGene® FAS-X outperforms common Blue LED systems by offering efficient excitation across a broader range of wavelengths, ensuring better and more satisfactory results.

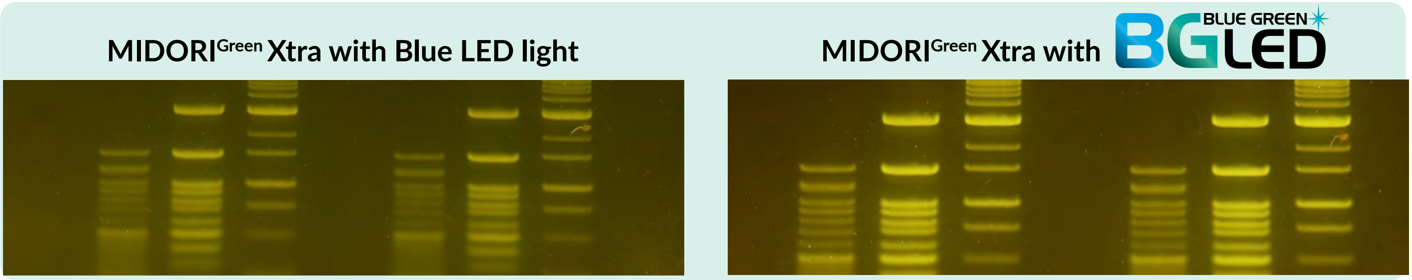
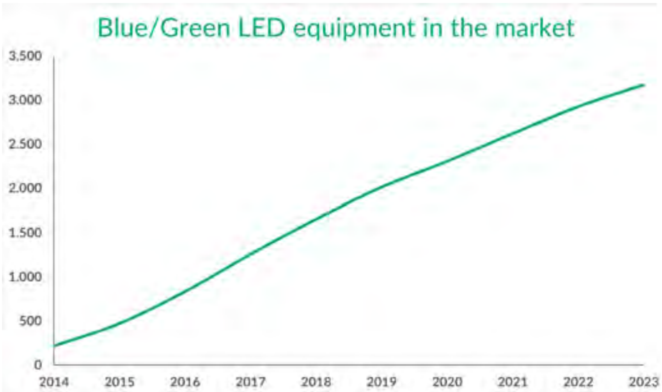


Figure 5: Comparison of MIDORI Green Xtra DNA dye Illumination with Blue LED light and Blue/Green LED Technology. *This example demonstrates the superior excitation of MIDORI Green Xtra by Blue/Green LED light. The enhanced spectrum (470-520 nm) allows more light energy to be absorbed by the dye, resulting in a more sensitive signal and clearer results.*

Conclusion

Blue/Green LED technology addresses the critical challenges posed by traditional UV and common Blue LED transilluminators. By ensuring user and sample safety, offering unmatched versatility, and delivering exceptional performance, the gel documentation system FastGene® FAS-X stands out as an indispensable tool for modern laboratories. Researchers can rely on this advanced system to streamline their workflows, reduce costs, and achieve accurate, reliable results.



The rising adoption of Blue/Green LED Technology in the life sciences sector highlights the growing recognition of these advantages. Since 2014, the number of Blue/Green LED systems sold has steadily increased, reaching over 3000 units by 2024. This trend underscores the increasing preference for Blue/Green LED technology over traditional UV light and Blue LED transilluminators, as more researchers experience its benefits firsthand.

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