Comparative analysis of DNA detection sensitivity using agarose gels pre-stained with MIDORI^{Green} dyes and ethidium bromide

Products

MIDORI^{Green} Xtra (MG10)
MIDORI^{Green} Advance (MG04)

Manufacturer

NIPPON Genetics EUROPE GmbH

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

Purpose

The purpose of this study is to compare the DNA detection sensitivity of agarose gels pre-stained with two different nucleic acid dyes, MIDORI^{Green} Advance (MGA) and MIDORI^{Green} Xtra (MGX), against the traditional dye, ethidium bromide (EtBr). This comparison aims to determine whether MGA and MGX can serve as safe and effective alternatives to EtBr.

Summary

MGA and MGX are nucleic acid staining reagents designed to offer a safer alternative to EtBr, a commonly used but potentially hazardous dye. This technical note details a comparative analysis of the DNA detection sensitivity of these dyes when used in agarose gels, visualised by Blue/Green LED technology.

Reagents and materials

- MIDORI[Green] Xtra (MG10)
- MIDORI[Green] Advance (MG04)
- Ethidium bromide (EtBr)
- FastGene® Agarose (AG01, AG02)
- Mupid® One Electrophoresis System (MU2)
- FastGene® 1 kb DNA Marker Plus (MWD1P) as a DNA sample
- FastGene® FAS-DIGI PRO (GP-07LED)

Experimental procedure

1. 1% agarose gels (3x) were prepared according to the manufacturer‘s instructions: 1.0 g agarose was dissolved in 100 mL TEA buffer.
2. The dyes (MGA, MGX, and EtBr) were added to separate dissolved gels according to the manufacturer’s instructions: MIDORI[Green] 4-6 µl per 100 mL and EtBr 5 µl per 100 mL of 10 mg/ml EtBr solution.
3. FastGene® 1 kb DNA Marker Plus was loaded on each gel (5 µl) was loaded in varying volumes (5.0 µl, 2.5 µl, 1.25 µl, 0.625 µl) to compare detection sensitivity.

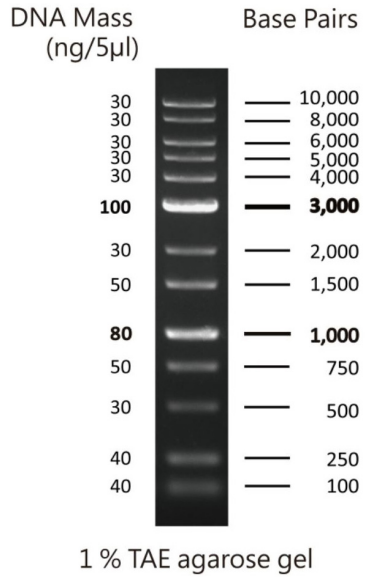

Figure 1: FastGene® 1 kb DNA Marker Plus.
Electrophoretic separation of DNA fragments of FastGene® 1 kb DNA Marker Plus on a 1% TAE agarose gel. The DNA fragment sizes in base pairs (bp) range from 100 bp to 10,000 bp.

4. The gels were run on Mupid® One Electrophoresis System (MU2) at 135 V for 30 min.
5. A Blue/Green LED system (FastGene® FAS-DIGI PRO) was used to visualize the gels.

Results

Detection sensitivity

The DNA detection sensitivity was evaluated based on the visibility of DNA bands at different molecular weights and amounts. The results were documented with full images and zoomed sections highlighted with white frames.

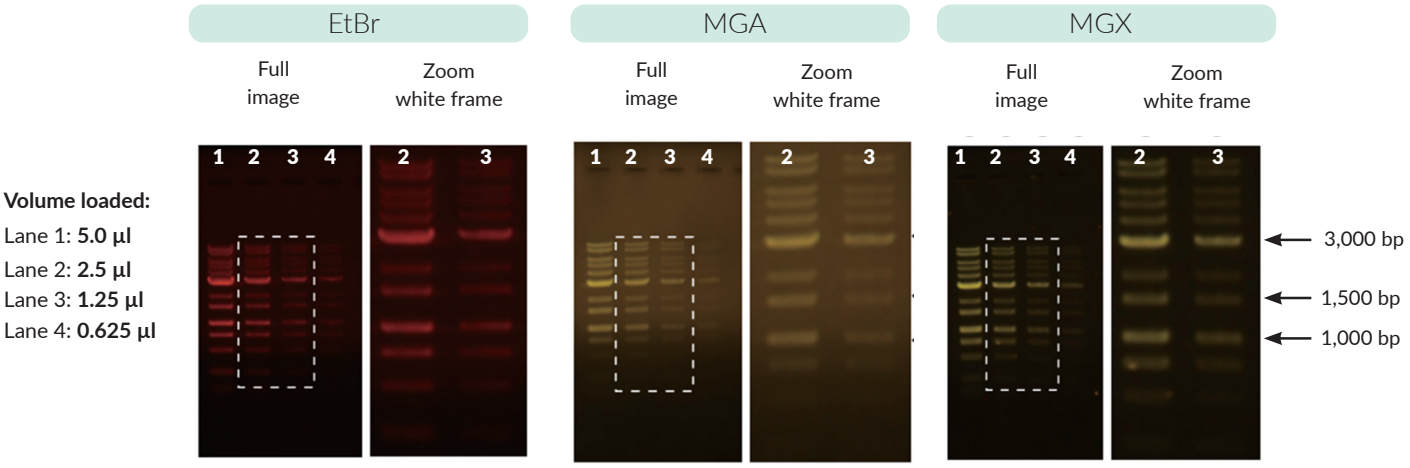

Figure 2: Comparison of DNA gel electrophoresis staining with ethidium bromide (EtBr), MIDORI[Green] Advance (MGA), and MIDORI[Green] Xtra (MGX).
DNA fragments of FastGene® 1 kb DNA Marker Plus (figure 1) separated by gel electrophoresis and stained with three different DNA dyes: ethidium bromide (EtBr; left), MIDORI[Green] Advance (MGA; centre), and MIDORI[Green] Xtra (MGX; right).
For each staining dye, two sets of gel images are shown: the first (left) shows the full gel image, while the second (right) highlights a specific region (dashed rectangle) for closer comparison of staining efficiency and band clarity. Lanes 1 - 4 contain a DNA marker (FastGene® 1 kb DNA Marker Plus) loaded in different volumes.

Both MIDORI[Green] dyes (MGA and MGX) match the DNA detection sensitivity of EtBr. The table below (table 1) provides a detailed comparison of DNA detection sensitivity using the three nucleic acid dyes refered in this study.

Table 1: DNA band visibility across EtBr, MGA, and MGX.

Lane	Marker bp	Amount of DNA	EtBr	MGA	MGX
2	3,000 bp	~25 ng/band	☑	☑	☑
2	1,500 bp	~12.5 ng/band	☑	☑	☑
2	1,000 bp	~7.5 ng/band	☑	☑	☑
3	1,000 bp	~3.75 ng/band	☑	☑	☑

As demonstrated in the table 1, the MIDORI[Green] dyes are capable of detecting DNA bands at varying concentrations and molecular weights, comparable to EtBr.

Conclusion

The study demonstrates that MIDORI^{Green} dyes line exhibit DNA detection sensitivities comparable to EtBr when used for pre-staining agarose gels. Both MIDORI^{Green} dyes detected DNA bands effectively at similar concentrations to EtBr, indicating their potential as completely safe alternatives for DNA visualization in agarose gel electrophoresis.

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