

GelRed™ & GelGreen™

Environmentally safe and ultra-sensitive nucleic acid gel stains for replacing EtBr

April 6, 2009

GelRed™ Is Superior to EtBr

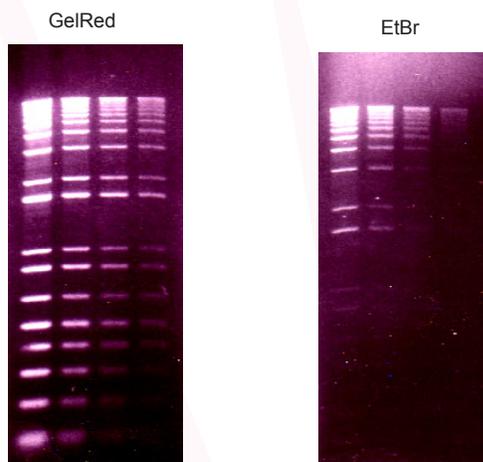


Figure 1. Comparison of GelRed™ and ethidium bromide (EtBr) in precast gel staining using 1% agarose gel in TBE buffer. Two-fold serial dilutions of 1 kb Plus DNA Ladder from Invitrogen were loaded onto each gel in 4 lanes in the amounts of 200 ng, 100 ng, 50 ng and 25 ng, respectively, from left to right. Gels were imaged using a 300-nm transilluminator and photographed with an EtBr filter and Polaroid 667 black-and-white print films.

FEATURES

- **Safer than EtBr**
Shown by Ames test and other tests to be nonmutagenic and noncytotoxic.
- **Easy disposal**
Passed environmental safety tests for direct disposal down the drain or in regular trash.
- **Ultra-sensitive**
Much more sensitive than EtBr and SYBR® Safe.
- **Extremely stable**
Available in water, stable at room temperature for long-term storage and microwavable.
- **Flexible for different procedures**
Can be used for either precast or post gel staining
- **Simple to use**
Very simple procedures for precast and post gel stainings.
- **Perfect Compatibility with a Standard UV Transilluminator or a Gel Reader with Visible Light Excitation**
GelRed replaces EtBr with no optical setting change; GelGreen replaces SYBR® or GelStar® with no optical setting change (See Figure 3 for spectra).

GelGreen™ Is Simply Unmatched by SYBR® Safe

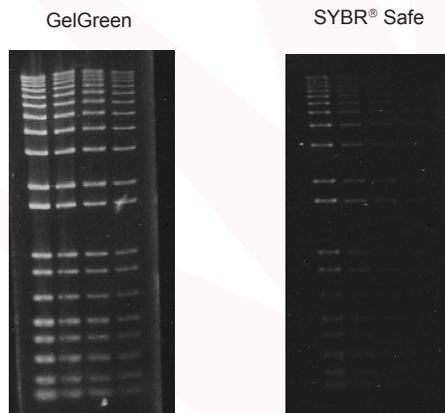


Figure 2. Comparison of GelGreen™ and SYBR® Safe in post gel staining using 1% agarose gel in TBE buffer. Two-fold serial dilutions of 1 kb Plus DNA Ladder from Invitrogen were loaded onto each gel in 4 lanes in the amounts of 200 ng, 100 ng, 50 ng and 25 ng, respectively, from left to right. Gels were imaged using a 254-nm transilluminator and photographed with a SYBR® filter and Polaroid 667 black-and-white print films.

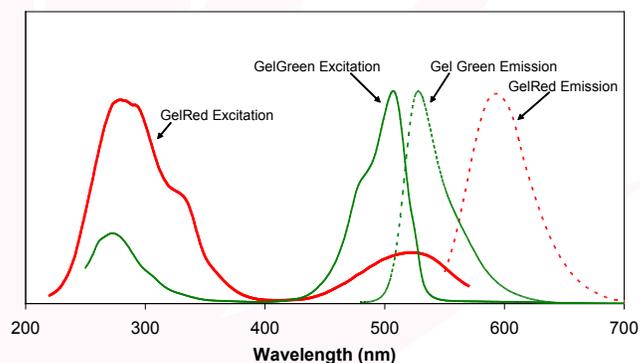


Figure 3. Normalized excitation and emission spectra of GelGreen™ (green) and GelRed™ (red) in the presence of dsDNA in PBS buffer.

GelRed™ & GelGreen™



GelRed and GelGreen are a new generation of fluorescent nucleic acid gel stains designed to replace the highly toxic ethidium bromide (EtBr). Developed by scientists at Biotium, GelRed and GelGreen are superior to EtBr and other EtBr alternatives by having a combination of low toxicity, high sensitivity and exceptional stability.

EtBr has been the predominant dye used for nucleic acid gel staining for decades because of its low price and generally sufficient sensitivity. However, EtBr is a highly mutagenic material. The safety hazard and costs associated with decontamination and waste disposal can ultimately make the dye expensive to use. For this reason, alternative gel stains, such as SYBR® dyes, have become commercially available in recent years. Although these alternative dyes have reduced mutagenicity, they often have to sacrifice other aspects of the dyes. For example, SYBR® Safe has very limited sensitivity while SYBR® Green and SYBR® Gold are much less stable than EtBr. SYBR® dyes also enter cells rapidly to stain mitochondria and nuclear DNA, making it more likely for the dyes to be toxic at high enough concentrations. Indeed, SYBR® Green I is known to strongly potentiate mutation caused by UV light or another mutagen (Ohta, et al. *Mutat. Res.* **492**, 91(2001)).

To make GelRed and GelGreen safe, scientists at Biotium used a novel yet very simple concept: reducing genotoxicity by preventing the dyes from entering living cells. We believe that a DNA-binding dye can be made nonmutagenic or substantially so by denying its chance to be in contact with genomic DNA in living cells. Thus, we engineered the chemical structures of GelRed and GelGreen such that the dyes are incapable of crossing cell membranes. The Ames test confirmed that GelRed and GelGreen are nonmutagenic at concentrations well above their working concentrations used for gel staining. Furthermore, environmental safety tests showed that GelRed and GelGreen are nonhazardous and nontoxic to aquatic life. As a result, GelRed and GelGreen can be disposed of down the drain or in regular trash. For more information, please download the GelRed/GelGreen Safety Report on Biotium website.

GelRed and GelGreen are highly sensitive either as precast gel stains or post gel stains. Designed primarily for use with a 312/302 nm UV transilluminator, GelRed is much more sensitive than EtBr, and at least as sensitive as or brighter than SYBR® Gold in post gel staining. Unlike SYBR® Gold, GelRed can also be used as a highly sensitive precast gel stain. GelGreen is developed to meet the needs of researchers who use a 488 nm laser-based gel scanner or a Dark Reader that uses a visible blue light for excitation. GelGreen is spectrally similar to SYBR® Safe, but is far more sensitive than the latter.

Another major advantage of GelRed and GelGreen is their remarkable stability. You can handle the two dyes the same way you do with EtBr. This means that the dyes are perfectly stable in water at room temperature for long-term storage, and they can be microwaved for making precast gels. Both dyes are also very photostable, permitting their use under normal room light without exercising special precaution.

A complete list of GelRed and GelGreen products is shown in Table 1.

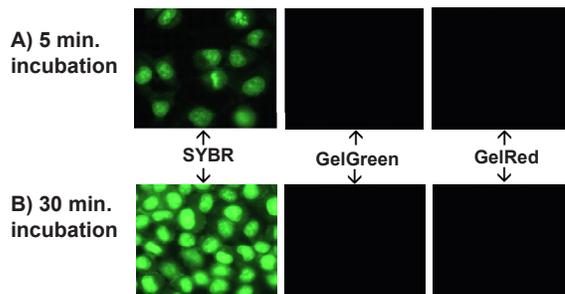


Figure 4. HeLa cells were incubated at 37 °C with 1X of SYBR® Green I, SYBR® Safe, GelGreen™ and GelRed™, respectively. Images were taken following incubation for 5 min (panel A) and 30 min (panel B), respectively. SYBR® Green I and SYBR® Safe entered into cells rapidly as evident from the bright green nuclear staining (images from SYBR® Safe not shown). However, GelRed™ and GelGreen™ were unable to cross cell membranes as shown by the lack of any fluorescence staining.

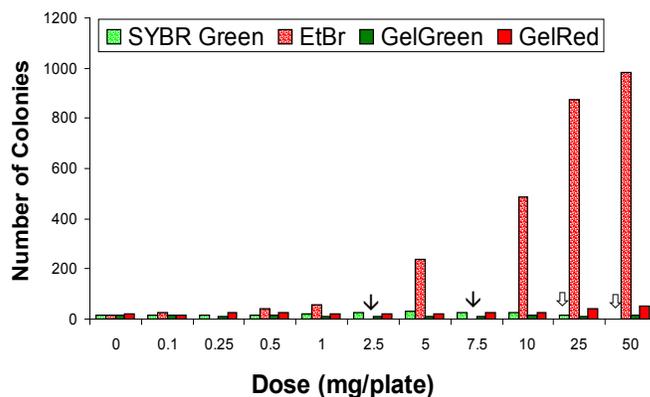


Figure 5. Comparison of mutagenicity among GelGreen™, GelRed™, SYBR® Green I and EB in +1 frameshift Salmonella indicator strain TA98 with the presence of S9 fraction. "↓" indicates EB was not tested at this concentration. "⊥" indicates SYBR® Green I became cytotoxic at this concentration. For more information, you can download GelRed™ and GelGreen™ Safety Report on Biotium website.

Table 1. Gel Stain Product List

Cat.#	Product Name	Unit Size
41003	GelRed™, 10,000X in H ₂ O	0.5 mL
41003-1	GelRed™, 10,000X in H ₂ O	10 mL
41001	GelRed™, 3X in H ₂ O	4 L
41002	GelRed™, 10,000X in DMSO	0.5 mL
41005	GelGreen™, 10,000X in H ₂ O	0.5 mL
41005-1	GelGreen™, 10,000X in H ₂ O	10 mL
41004	GelGreen™, 10,000X in DMSO	0.5 mL

* GelGreen™ and GelRed™ are covered by pending US and international patents.
 ** SYBR is a trademark of Molecular Probes, Inc.