

## Introduction

Innovations in agarose gel electrophoresis, especially in terms of automation, have dramatically lagged behind other basic laboratory techniques. Reasons for this delay include the fact that neither the process of pouring a gel nor the classic equipment, a gel box containing buffer, is robot-compatible. As a result, agarose gel electrophoresis becomes the bottleneck in most high throughput (HTP) processes.

Here we present a novel system that solves many of the issues surrounding HTP agarose electrophoresis. The E-Gel<sup>®</sup> 96 system is a complete agarose electrophoresis system, including a pre-cast gel cassette and power supply. The gel cassette is a disposable unit consisting of agarose and electrodes in a hard plastic, UV-transparent case. The gel contains 104 wells (96 sample and 8 marker wells) and ethidium bromide. No buffer is required for operation. The cassette fits into a space-saving pre-programmed power base (the E-Gel<sup>®</sup> 96 mother or daughter base) for a 12-minute electrophoresis run. Mother and daughter bases can be connected together to run multiple gels from a single outlet. The bases are designed with SBS standard sizing, are compatible with robotic platforms, and serve to align the wells of the E-Gel<sup>®</sup> 96 cassette with the robot's tips for automated loading. For marking in HTP operations, each gel cassette is marked with a unique barcode.

Here, the advantages of the staggered-well format, which enables a 1.8-cm run length, will be discussed. In addition, data on performance and throughput on several robotic platforms will be outlined, along with specific applications for genomic and proteomic laboratories.

## Issues for HTP Agarose Electrophoresis

Agarose electrophoresis is a useful method for quality control or quantitation of DNA or RNA samples prior to downstream processes. However, in an HTP environment the laborious and robot-incompatible methods of standard agarose gel electrophoresis dictate that this step either becomes a bottleneck or is eliminated in favor of throughput, often causing quality issues downstream.

Current methods of agarose gel electrophoresis are not adaptable to robotics due to,

- Gel issues- too flexible, slippery, incorrect sizing
- Well configuration- incorrect and inconsistent spacing, excess agarose, holes and tears
- Requirement for liquid buffer- large volumes needed, waste volumes, hazard (E1B)

## E-Gel<sup>®</sup> 96 System Enables HTP Agarose Gel Electrophoresis

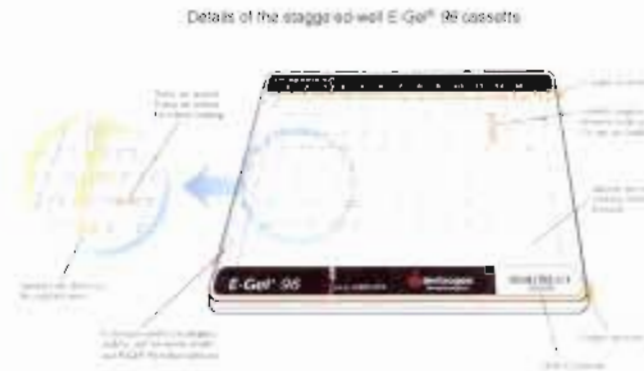


E-Gel<sup>®</sup> 96 gel in an E-Gel<sup>®</sup> 96 mother base being loaded by an 8-tip Tecan Genesis<sup>®</sup> robot

## E-Gel<sup>®</sup> 96 System Components

- Agarose gel cassette
- Mother base
- Daughter base
- Holder
- Editor software
- Markers

## E-Gel<sup>®</sup> 96 Gels



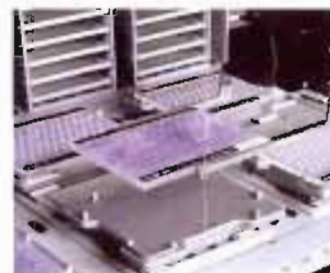
- Self-contained, disposable UV-transparent plastic cassette contain agarose, ethidium bromide, and electrodes
- Wells are in a patented, staggered-well format that allow for a 1.8 cm separation
- Gels are available in 1% and 2% agarose; 1% resolves 1 kb to 10 kb, 2% resolves 100 bp to 2 kb
- SBS standard well spacing allow multichannel manual or automated loading
- 20 µl load volume
- Fluorescent barcode and lane numbers
- Room temperature storage, 6 month shelf-life
- Three cross-hairs in cassette for Editor alignment

## E-Gel<sup>®</sup> 96 Mother and Daughter Bases



- A base and power supply in one unit
- Space-saving, small bench top footprint
- Mothers connect to any electrical outlet
- Daughters connect to mothers and to each other
- Connect up to 10 daughters to 1 mother
- Built-in timer, alarm, and lit-up digital display
- Base has a standard (SBS) 96-well plate footprint
- 12-minute run time, adjustable 1 - 20 minutes
- Low capital equipment investment

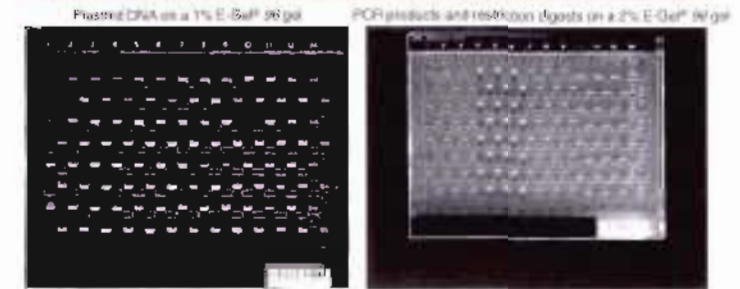
## E-Gel<sup>®</sup> 96 Holder



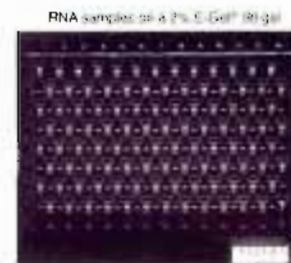
Use of robotic gripper with E-Gel<sup>®</sup> 96 gel from the E-Gel<sup>®</sup> 96 holder after loading on a Tecan Genesis<sup>®</sup> robot.

- Weighted placemat for loading gels on a robotic platform
- Holder is the same size as mother and daughter bases
- Base of the holder has standard (SBS) 96-well plate footprint
- Spring-loaded corner to hold gel cassette

## Electrophoresis of DNA and RNA Samples on E-Gel<sup>®</sup> 96 Gels

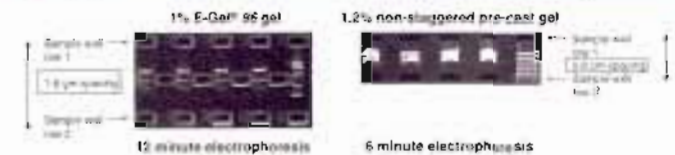


Fragmented DNA on a 1% E-Gel<sup>®</sup> 96 gel. PCR products and restriction digests on a 2% E-Gel<sup>®</sup> 96 gel. Lanes 1, 2, 3: 4 kb PCR product; lanes 4, 5: λ-DNA<sup>®</sup> 1. Accu-cut lanes 1, 2, 3 kb PCR product; lanes 10, 11, 12: 900 bp PCR product; M: 1 kb range DNA marker. 1 µl of PCR products, 1/10 µl of DNA digest loaded.



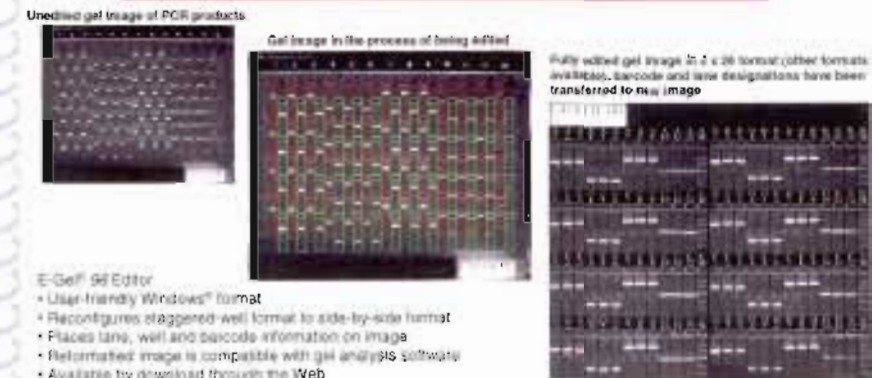
100 ng of 0.26 - 0.5 kb RNA Ladder loaded in each lane. Loaded by a Tecan robot.

## Staggered-Well Pattern Allows Maximum Sample Separation



Restriction digests (342 bp, 1351 bp, and 735 bp bands) resolved on a staggered-well E-Gel<sup>®</sup> 96 gel (left) or a non-staggered-well pre-cast format (right). The 1.8 cm well-to-well distance of the E-Gel<sup>®</sup> 96 gel clearly resolves the DNA fragments (lanes 1-4) and the Marker (lane 5). The samples (lanes 1-4) run on the non-staggered format are not resolved and the Marker (lane 5, developed by the manufacturer for this gel) is running into the next well.

## E-Gel<sup>®</sup> 96 Editor Software



- User-friendly Windows<sup>®</sup> format
- Reconfigures staggered-well format to side-by-side format
- Places lane, well and barcode information on image
- Reformatted image is compatible with gel analysis software
- Available by download through the Web

## Conclusions E-Gel<sup>®</sup> 96 System



- The ideal system for HTP, manual, or automated agarose gel electrophoresis
- Fast, convenient, easy- no mess, no hassles
- Complete system- gels, bases and holder, software, markers
- Analyze up to 20,000 samples per day
- For additional information: [www.invitrogen.com/egels](http://www.invitrogen.com/egels)