STANDARDIZED CometAssay® SYSTEM



CometAssay® For the direct measurement of DNA Damage

The ability of chemical substances such as pesticides, metals, polycyclic aromatic hydrocarbons (PAHs), solvents, gasoline additives, etc. to induce mutations and DNA damage in prokaryotic and eukaryotic cells has created the need to test these chemicals for their genotoxic potential before being used as products, and therefore released into the environment. Conventional methods for evaluating genetic damage, including chromosomal aberration, micronucleus assays and their sister chromatid exchanges are time consuming, resource intensive and require proliferating cell populations. Hence, cost effective and more sensitive test systems have now been introduced for assessing the genotoxicity of chemicals. The single cell gel electrophoresis or CometAssay® is one such state-of-the-art technique for guantitating DNA damage and repair in eukaryotic cells and some prokaryotic cells. This technique is rapid, non-invasive, sensitive, visual and inexpensive compared to conventional techniques and is a powerful tool to study factors impacting mutagenicity and carcinogenicity. It is the only technique that directly measures DNA damage in individual cells and as a result has rapidly gained importance in the fields of genetic toxicology and human and environmental biomonitoring. Used in conjunction with Trevigen's Electrophoresis Unit, the CometAssay® Control Cells, slides and reagents, measure double strand breaks (DSBs), single strand breaks (SSBs), alkali labile sites, oxidative DNA base damage, DNA crosslinking and DNA repair.



www.trevigen.com sales@trevigen.com



Complete **Standardized System**

CometAssay[®] Electrophoresis System

The standardized CometAssay® Electrophoresis System enables investigators to consistently optimize alkaline and neutral comet assays for highly reproducible results. It is used to standardize electrophoresis methods between individual users and laboratories. The comet assay is the only direct method for the detection of DNA damage in cells. It is used in cancer research, in genotoxicity studies on environmental mutagens, and for screening compounds for cancer therapeutics. Comet assay results can be variable depending on temperature, distance between electrodes, and buffer height. Trevigen, with funding from a Phase II SBIR grant**, has solved these problems and makes available a novel complete assay system which includes CometAssay[®] kits, CometSlides[™], Alkaline and Neutral CometAssay[®] Control Cells and a specialized electrophoresis unit. This unit retains test cells in a uniquely configured electrophoretic field permitting consistent DNA migration patterns, which are critical for standardization of the assay. Each lot of the CometAssay[®] Control Cells, reagents and CometSlides[™] developed by Trevigen are tested and gualified for use in the CometAssay[®] Electrophoresis System. Products are available in a Starter Kit (4250-050-ESK) or as individual components listed in the table to the right. The CometAssay® Electrophoresis System Starter Kit includes the Electrophoresis System (4250-050-ES), a CometAssay® Kit, with choice of 2-well, 20-well, or 96-well CometSlides[™] (4250-050-K, 4252-040-K, 4253-096-K), and CometAssay® Alkaline Control Cells (4256-010-CC). Order Neutral CometAssay[®] Control Cells separately (4257-010-NC).



CometAssay® System

CometAssay® Electrophoresis System II 4250-050-ES CometAssay® 2 Well ES Unit w/ Starter Kit and Power Supply for North America 4250-050-ESK CometAssay® 20 Well ES Unit w/ Starter Kit and Power Supply for North America 4252-040-ESK CometAssay® 20 Well ES Unit w/ Starter Kit and Power Supply for North America 4252-040-ESK CometAssay® 96 Well ES Unit w/ Starter Kit and Power Supply for North America 4253-096-ESK CometAssay® 96 Well ES Unit w/ Starter Kit and Power Supply for North America 4253-096-ESK-PS1 Reagent Kits Size Catalog No. CometAssay® Kit (12 X 20 well slides) 50 samples 4250-050-K CometAssay® Kit (1 X 96 well slide) 96 samples 4251-050-K CometAssay® Silver Staining Kit components 200 samples 4254-200-K Reagents Size Catalog No. CometAssay® Lysis Solution 2 x 500 ml 4250-050-02 CornetAssay® LMAgarose 100 ml 4250-050-02 CornetAssay® LAMagarose 100 ml 4250-010-01 CometAssay® LMAgarose 100 ml 4250-010-02 CornetAssay® LAMagarose 100 ml 4250-010-02 CometAssay® LMAgarose 100 assays 4257-010-NC <	Instrumentation	Catalo	g No.
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*PS = Power Supply

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Instrumentation



CometAssay® Electrophoresis Unit

Trevigen's CometAssay[®] ES overcomes variations by placing an acrylic overlay on top of an elevated slide tray to maintain optimal buffer height for consistent DNA migration. A constant buffer temperature is maintained using an underlying ice pack to cool the slide platform and buffer chamber. Specially designed slide trays are provided to accommodate 2, 20 and 96 well slides and maintain proper slide orientation in an electrophoretic field uniquely configured for single cell gel electrophoresis.

Kits

CometAssay[®] Kits

Trevigen's CometAssay® provides reagents and our exclusive CometSlide[™] for the rapid analysis of DNA fragmentation associated with DNA damage. Following lysis, the unwound, relaxed DNA is able to migrate out of the cell during alkaline or neutral electrophoresis and can be visualized using SYBR® Gold nucleic acid gel stain. Cells that have accumulated DNA damage appear as fluorescent comets with tails of DNA fragmentation or



Features

- Maintains constant buffer temperature.
- Maintains optimal buffer level for consistent results.
- Specially designed trays accommodate 2, 20 and 96 well slides and maintain correct position during electrophoresis.
- Optimized for use with CometAssay[®] Kits and CometAssay[®] Control Cells.
- Greater reproducibility and reduced variablity between individual users and different labs

CometAssay[®] Electrophoresis Unit

Description	Catalog No.
CometAssay [®] Electrophoresis Unit	4250-050-ES

unwinding, whereas, normal undamaged DNA does not migrate far from the origin. The CometAssay® is provided with our exclusive CometSlides[™] which greatly simplify the assay. Each slide provides surfaces specially treated to promote agarose adherence, and a hydrophobic barrier to allow treatment with one of Trevigen's DNA repair enzymes. Simply add your cells to the low melting point Comet LMAgarose, and pipet onto the slide.

CometAssay[®] Kits

Description	Size	Catalog No.
CometAssay [®] Kit (2 well)	50 samples	4250-050-K
CometAssay [®] HT Kit (20 well)	40 samples	4252-040-K
CometAssay® Kit (96 well)	96 samples	4253-096-K
CometAssay [®] Silver Kit (2 well)	50 samples	4251-050-K
CometAssay [®] Silver Straining Kit Components	50 samples	4254-200-K

CometAssay[®] Reagents

Description	Size	Catalog No.
CometAssay [®] Lysis Solution	100 ml	4250-010-01
CometAssay [®] Lysis Solution	2 x 500 ml	4250-050-01
CometAssay [®] LMAgarose	15 ml	4250-050-02
CometAssay [®] LMAgarose	100 ml	4250-500-02

CometSlides[¬]



CometSlides™

CometSlides[™] greatly simplify the comet assay by providing a sample surface specially treated to promote agarose adherence, and a hydrophobic barrier to allow treatment with one of Trevigen's DNA repair enzymes. The three well FLARE™ Slide can also be interchanged with the CometSlide[™]. Simply add your cells to the low melting point Comet LMAgarose, and pipet onto the slide.

CometShdes		
Description	Size	Catalog No.
CometSlide™ (2 Well, 2 Slides)	2 slides	4250-004-03
CometSlides™ (2 Well, 25 Slides)	25 slides	4250-050-03
CometSlides™ (2 Well, 100 Slides)	100 slides	4250-200-03
CometSlide™ (96 Well)	1 slides	4253-096-03
CometAssay [®] HT (20 Well, 2 Slides)	1 slides	4252-040-01
CometAssay [®] HT (20 Well, 10 Slides)	10 slides	4252-200-01
CometAssay [®] HT (20 Well, 25 Slides)	25 slides	4252-500-01
CometAssay [®] HT Slides (20 Well, 100 Slides)	100 slides	4252-02K-01
FLARE™ Slides (3 Well, 25 Slides)	25 slides	3950-075-02
FLARE™ Slides (3 Well, 100 Slides)	100 slides	3950-300-02
CometSlide™ Rack System	each	4252-040-02

96 Well CometSlide™

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CometAssay [®] Control Cells (Alkaline)		CometAs	CometAssay [®] Control Cells (Neutral)				
Component	Quantity	% DNA in Tail	Catalog No.	Component	Quantity	Tail Moment	Catalog No.
Healthy Cells	500 µl	5.76%	4256-010-CC0	Healthy Cells	500 µl	0.68	4257-010-NC0
Treated Cells - Level 1	500 µl	28.37%	4256-010-CC1	Treated Cells - Level 1	500 µl	4.32	4257-010-NC1
Treated Cells - Level 2	500 µl	39.74%	4256-010-CC2	Treated Cells - Level 2	500 µl	15.71	4257-010-NC2
Treated Cells - Level 3	500 µl	56.80%	4256-010-CC3	Treated Cells - Level 3	500 µl	25.73	4257-010-NC3

Typical Alkaline CometAssay[®] Results



Control Cells

CometAssay[®] Control Cells

For the standardization of comet assays

Trevigen's CometAssay® Alkaline and Neutral Control Cells are sets of cell preparations containing different levels of DNA damage to be used with Trevigen's CometAssay® Kits. In a typical comet assay, electrophoresis methods and differences in cell preparations create a significant source of variation in comet tail parameters. Such variation sometimes makes it difficult to compare results between laboratories, and even within the same lab. To overcome this problem, Trevigen scientists developed sets of stable control cell populations containing incremental levels of DNA damage for use when performing the CometAssay®. These control cells, when electrophoresed in the CometAssay® consistently produce four distinct populations. Healthy control cell populations (CCO or NCO) were treated under various conditions to increase the amount of damage in the corresponding populations. These cryopreserved control cells are designed to act as controls to standardize and compare electrophoresis methods between individual users and laboratories.



CometAssay® Control Cells

Description	Size	Catalog No.
CometAssay® Alkaline Control Cells	1 Set (10 Assays)	4256-010-CC
CometAssay® Neutral Control Cells	1 Set (10 Assays)	4257-010-NC

Data Analysis

Comet Analysis

Electrophoresed cells once stained with a DNA specific fluorescent probe are typically visualized with a fluorescent microscope equipped with a camera. Cells are positioned with the bright cell nucleus or head to the left side of the camera view and the comet tail extending to the right. The fluorescence of the comet tail represents DNA that has migrated outside of the head region due to fragmentation. The fluorescent tail length increases as a function of DNA damage, but the maximum tail length is defined by the electrophoresis conditions. Fluorescent intensity continues to increase as more DNA migrates into the tail, so optimization of electrophoresis conditions is critical, but easy if a CometAssay® ES unit is used.

Typical measurements are the percent DNA in the Tail (normalized to total cell DNA) and Tail Moment. Tail Moment is a damage measure combining the amount of DNA in the tail with the distance of migration (severity of damage). Commercial scoring systems provide analytic measures of the head and tail to quantify the degree

Typical Neutral CometAssay® Results





of damage revealed by the comet assay. To allow for analysis of bright comet heads and dim comet tails, scoring systems differ based on the dynamic range of the camera and interpretation of the head position used to determine tail length and intensity measurements.

5





Designed for CometAssay[®] reagents and Electrophoresis System

CometChip® for High Throughput CometAssay®

The 96-Well CometChip[®] System is a high-throughput platform to simultaneously treat and measure DNA damage induced by different treatments, or among different cell types on a single slide using the comet assay. The CometChip® is a consumable consisting of specifically sized micron pores patterned into agarose. 96 separate wells are created by inserting the CometChip® into a reusable magnetically-sealed cassette suitable for tissue culture incubators. Cells added to each well are captured by gravity into micropores and excess cells are aspirated, leaving an array of non-overlapping cells. Multiple experimental conditions are performed in parallel by the addition of different chemicals to respective wells. Once treatment is complete the CometChip® is removed from the cassette and processed using standard alkaline comet conditions and imaging systems.

CometChip® Products

Description	Size	Catalog No.
CometChip [®] (30 micron)	each	4260-096-01
CometChip [®] Kit	96 samples	4260-096-K
96-Well CometChip® System	1 each	4260-096-CS
CometChip [®] Starter Kit	96 samples	4260-096-CSK
CometChip [®] Electrophoresis Starter Kit	1 each	4260-096-ESK



Sample 4X Macrowell Image

Related Products

Trevigen's unique FLARE[™] (Fragment Length Analysis using Repair Enzymes) Assays provide the ability to characterize DNA damage in single cells using a variety of DNA repair enzymes in conjunction with Trevigen's CometAssay® Electrophoresis System. To assess the type of DNA damage induced by a putative mutagen, drug, or treatment regimen, cells are harvested after treatment and immobilized in a layer of low melting point agarose on the FLARE[™] Slide. Following electrophoresis, an apparent increase in damage as a result of enzyme addition is indicative of unrepaired but recognized molecular lesions within the DNA.

Researchers who purchased CometAssay[®] products also purchased these.

FLARE™ Assay Kits and Modules			
Catalog #	Product Name	Size	
3950-075-SP	FLARE™ Sample Prep	75 tests	
4040-100-FK	Fpg FLARE™ Assay Kit	75 samples	
4040-100-FM	Fpg FLARE™ Module	100 samples	
4045-01K-FK	E. coli Endonuclease III FLARE™ Kit	75 samples	
4045-01K-FM	E. coli Endonuclease III FLARE™ Module	100 samples	
4130-100-FK	hOGG1 FLARE™ Assay Kit	75 samples	
4130-100-FM	hOGG1 FLARE™ Module	100 samples	

Citations

c-MVC suppresses BIN1 to release Poly(ADP-Ribose) Polymerase1: A mechanism by which cancer cells acquire cisplatin resistance Neutral CometAssay®

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Alkaline CometAssay®

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FAOS

1. Will any commercial horizontal gel electrophoresis device work for electrophoresis?

Comet assay ,variability led to the development of our new CometAssav® Electrophoresis System. Conventional slab gel electrophoresis chambers are not designed to eliminate all known causes of comet assay variability. They can be used, but they require optimization by the user to achieve consistent results. We recommend using Trevigen's CometAssay® Electrophoresis System which addresses these issues and for highly reproducible results.

2. Why is LMAgarose recommended?

The agarose used must be a liquid at 37° C. Use of gel electrophoresis agarose is not recommended due to the risk of introducing DNA damage at high temperatures.

3. Why is there loss of agarose disks from the CometSlide[™]?

CometSlides[™] are specially treated in order to enhance agarose binding during alkaline treatment. Special attention needs to be paid during spreading of LMAgarose on the slides. Generally, place 50 ul LMAgarose on the center of each well (2 well slides) and then gently spread the agar using the side of a pipette tip. You don't want a mound of agar in the center, because the adhesion area needs to be in contact with the agar over the entire well. Be careful not to get any LMAgarose on the red or blue masking for when it dries, it increases the chances of the agar coming off or folding over.

- a. All processing of the slides needs to be done very gently. Place the slides into solutions; never pour or decant buffer onto CometSlides™.
- b. For more detailed information please see: www.trevigen.com.

4. How often do you recommend using CometAssay® **Control Cells?**

Use of control cells in each and every electrophoresis run is recommended as a best practice to generate high quality CometAssay® data. Please see: Kumaravel et al., Comet Assay measurements: a perspective. Cell Bioi Toxicol (2009) 25:53-64.

5. The high throughput comet slide (CometSlide[™] HT 4252-200-01) has 20 sample wells; is it possible to re-use the slide if not all wells were utilized?

This is not recommended since the slides contain a special coating for binding the agarose, which can be compromised if washed for re-use.

6. Is there a convenient step to stop the CometAssay® and resume the next day due to time constraints?

It should be possible to cryopreserve your samples on day one, run the assay on day two; dry the LMAgarose disks

containing the electrophoresed nucleoids down, and store overnight with staining on day three.

7. Do you recommend use of the CometAssay® (4250-050-K) with whole blood?

We do not recommend using whole blood with the CometAssay® because sample preparation is critical and hemoglobin could damage DNA. It's important to note that red blood cells (major blood component) do not have a nucleus (i.e. genomic DNA) and therefore are not suitable for use with CometAssay®. Rather, assay of isolated leukocytes is preferred.

8. What image analysis tools are available for scoring comets?

PC software: A free 3~-day trial of Comet Assay IV, a commercial software system designed specifically for the comet assay, can be downloaded from http://www. scorecomets.com. Comet Assay IV includes all major measurement parameters and is the most advanced system available on the market today. Features include point-and-click scoring and options for regulatory compliance.

Mac software: NIH Image, a free general purpose image analysis tool, is available from *http://rsb.info.nih.gov/* nih-image. This software can be used along with custom macros specifically designed to give comet tail moment. A useful macro for calculating the tail moment from saved digital images has been provided by Professor Herbert M. Geller, Ph.D.

If you need assistance regarding analysis of large sample sets, please contact us!

9. How long can a CometSlide[™] (4250-050-03) be stored?

Prior to staining, dried slides stored with desiccant can be kept for extended periods (months). Using the CometAssay® Silver Staining Kit, permanent records are created and visualization using standard light microscopy is possible.

10. Will the CometAssay® (4250-050-K) work with solid tissue? If so how?

Carefully prepared cell suspensions from tissues can be used with the CometAssav®.

Protocol Guideline

- 1. Place a small piece of tissue in 1-2 ml of cold HBSS containing 20 mM EDTA.
- 2. Mince the tissue into fine pieces and allow settling.
- 3. Remove 5-10 ml of the supernatant (cell suspension) and combine with 75 ml molten LMAgarose. To ensure the cell concentration and dissociation are sufficient, a small aliguot can be diluted in PBS (instead of LMAgarose) and spotted onto a microscope slide. Another option is to digest the tissue for 15 minutes with trypsin, wash with HBSS or cold PBS containing serum to inactivate the enzyme, and then mechanically dissociate using syringe and needle.

For more FAQS, please visit www.trevigen.com

What Customers Say

Larry Gladnick **Pharmaceutical Scientist**

"I initially purchased the CometAssay® Control Cells for the purpose of training others to manually score Comet cells. The slides were straightforward to prepare, and were an excellent addition to the training regime used by my colleagues. Not only are the 4 different types of control cells significantly different when comparing % tail DNA, they are also easily differentiated under the scope or with image analysis. This was an added benefit for training. In the future I will use the CometAssay® Control cells as additional controls in our in vitro/in vivo Comet studies to ensure study reproducibility between trials and individual experimenters."

About Us

Trevigen, Inc is an innovative biotechnology company focused on the development of products and technologies for cell behavior, including stem cell/ regenerative medicine and cancer research. Trevgien has core technologies in protein purification, cell biology and DNA damage and repair. The company is the recipient of several NIH SBIR grants from the National Institute of Health, concerning technology development for the analysis of DNA Damage, and an SBIR Contract for the development of an in vivo co-culture breast cancer model. The Trevigen Research and Development team has a number of thought leaders in the fast growing 3-D Cell Culture research field, who have helped the company become a pioneer in the industry by developing some of the first commercially available products for 3-D Culture research.

Comet Assay Service

At your request, the scientists at TCA (Trevigen Cell Assays- our contract research division) will collaborate with you to design screening studies employing the CometAssay® tailored for your specific needs. Contact us and request a quote.

www.trevigen.com • sales@trevigen.com • 1 800-TREVIGEN

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Avinash M. Tope, PhD **Principal Investigator** Kentucky State University

"We perform CometAssay® routinely at the Human Health and Nutrition Research, Kentucky State University, and are interested in investigating DNA protective capacity of bioactive compounds found in vegetables and fruits. We have been using various Trevigen products including the Fpg FLARE[™] kit. We are pleased with their performance quality and services."



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