GlutaMAX™ Media

GIBCO™
cell culture

Get the most from your cell cultures with GlutaMAX™ media.

Spontaneous Decomposition of L-glutamine

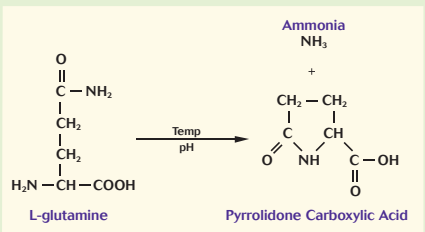

Figure 1. L-glutamine spontaneously decomposes into ammonia and pyrrolidone carboxylic acid at a decomposition rate dependent on pH and temperature.[1]

Stability of GlutaMAX™-I vs. L-glutamine in D-MEM

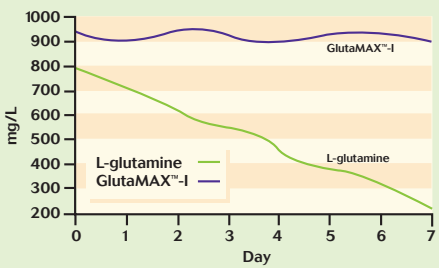

Figure 2. D-MEM was supplemented with GlutaMAX™-I or L-glutamine, aliquoted into vials and stored at 37˚C. *Samples were taken daily and frozen at -20˚C. Levels of GlutaMAX™-I and L-glutamine were determined by HPLC.*

GlutaMAX™ Media

- *Increase media stability*
- *Minimize toxic ammonia build-up*
- *Maximize cell performance*

L-glutamine is an essential nutrient in cell cultures for energy production as well as protein and nucleic acid synthesis. However, L-glutamine in cell culture media spontaneously degrades (figure 1). This generates ammonia as a byproduct, which is toxic to the cells[2] and can affect protein glycosylation[3,4] and cell viability, lowering protein production and changing glycosylation patterns.

Lower ammonia concentrations can be advantageous in attaining high cell yields, particularly for cells that are sensitive to ammonia toxicity.[5] Cells can be sensitive to ammonia even at non-toxic levels, creating artifacts.

Media Stability Keeps Cells Healthier, Longer

GIBCO™ GlutaMAX™ media are standard cell culture media that contain a stabilized form of L-glutamine, the dipeptide L-alanyl-L-glutamine, that prevents degradation and ammonia build-up even during long-term cultures (figures 2 and 3). Extremely stable in aqueous solution, the dipeptide does not degrade in storage or incubation.

Stable Dipeptide Maximizes Cell Performance

The dipeptide makes the difference.

The GlutaMAX™ dipeptide is split by aminopeptidases, releasing L-glutamine and L-alanine from the dipeptide.

The mechanism of dipeptide utilization involves the gradual release of peptidase during culture to allow the gradual hydrolysis of the dipeptide in the medium (figure 4). This can be compared to the strategy of a fed-batch culture in which L-glutamine is continuously fed into the culture but maintained at low concentration. The result is an efficient energy metabolism and a high-growth yield.

The GlutaMAX™ dipeptide (GlutaMAX™-I Supplement*) can be used as a direct substitute for L-glutamine with minimal or no adaptation.[6]

Now you can increase media stability, minimize toxic ammonia build-up, and maximize cell performance. Get the most from your cell cultures with GlutaMAX™ media.

Ammonia Levels in Supplemented Media

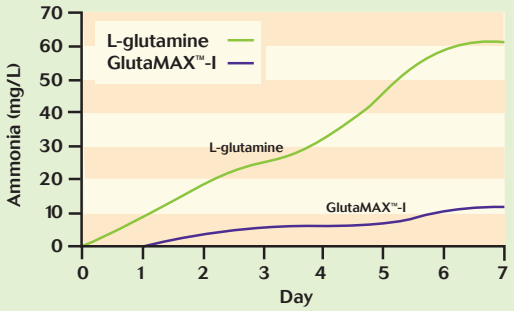

Figure 3. D-MEM was supplemented with GlutaMAX™-I or L-glutamine, aliquoted into vials and stored at 37˚C. *Samples were taken daily and frozen at -20˚C. Levels of ammonia were determined by HPLC.*

Stable Dipeptide Delivery

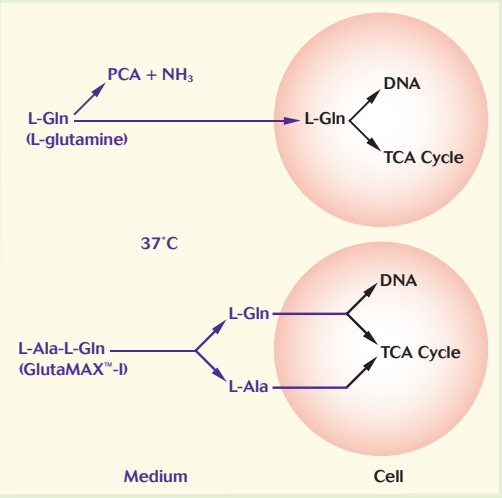

Figure 4. Controlled delivery of L-glutamine from media to cells in culture.

Growth of AE-1 Cells

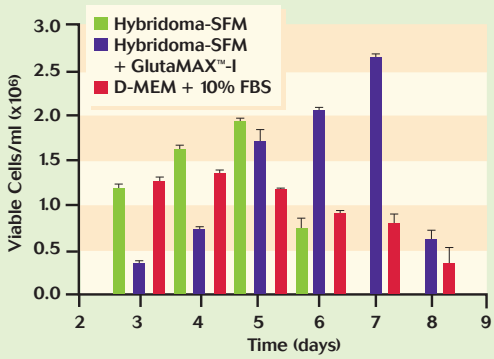

Figure 5. Cell Growth. *AE-1 mouse myeloma cells were seeded at 1 × 10^5 cells/ml. Samples were taken daily after three days and evaluated in triplicate for cell density. Cell viability was determined by trypan blue exclusion. Cell density continued to increase in samples containing GlutaMAX™-I past the point when L-glutamine containing samples decreased in cell density.*

IgG_1 Production by AE-1 Cells

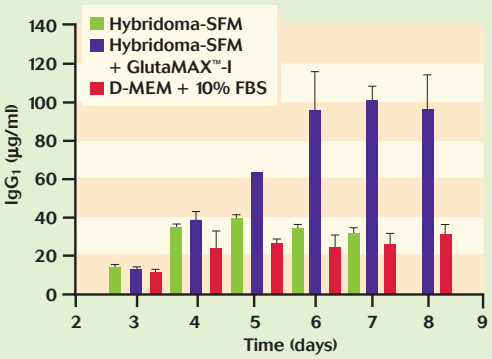

Figure 6. IgG_1 Production. *The samples from figure 5 were also examined by ELISA for IgG_1 production. GlutaMAX™-I containing samples outperformed L-glutamine containing samples.*

Obtain Equivalent or Improved Production Yields

While results may vary depending upon the cell line, using GlutaMAX™-I Supplement in place of L-glutamine in cell culture can improve cell viability and growth, potentially increasing productivity levels. In an application-specific example, figures 5 and 6 show an AE-1 cell growth curve and recombinant lgG_1 production. The GlutaMAX™-I culture demonstrates improved cell numbers and productivity.

GlutaMAX™-I Supplement can also extend cell culture life, which may reduce the number of times the cells must be passaged. Figure 7 compares MDBK cells cultured in D-MEM with 10% FBS and L-glutamine or GlutaMAX™-I Supplement. Cells cultured in GlutaMAX™-I reach peak density two days later and viability declines less rapidly than that observed in cultures with L-glutamine supplementation. The slight increase of the lag phase is attributed to the time needed to release the peptidase and digest the dipeptide. This allows a gradual increase in availability of L-glutamine to the cells.[2]

Choose From Many Formulations

We offer many widely used liquid media formulations in which the GlutaMAX™ dipeptide substitutes for L-glutamine. They include D-MEM, MEM, IMDM, RPMI, Opti-MEM®, and others. For details, see the insert in this brochure or the GIBCO™ catalog.

Do It Yourself with GlutaMAX™-I Supplement

You can purchase the GlutaMAX™ dipeptide as a stand-alone supplement. Use this 200 mM solution, GlutaMAX™-I Supplement, as a direct substitute for L-glutamine at equimolar concentrations in your current cell culture media formulation.

Note: This supplement is suitable for mammalian cell cultures. It is not recommended for insect cell cultures.

Applications for GlutaMAX™ Media

GlutaMAX™ media and media supplemented with GlutaMAX™-I are suitable for both adherent and suspension mammalian cell cultures including:

- Culture systems requiring long periods of incubations without feeding (e.g., cloning assays)
- Long-term studies requiring optimum standardization of media (e.g., cancer cell lines, long-term cultures passaged over time, toxicity testing)
- Culture systems sensitive to ammonia (e.g., high-density bioreactors)

Growth of MDBK Cells in D-MEM Supplemented with L-glutamine or GlutaMAX™-I and 10% FBS

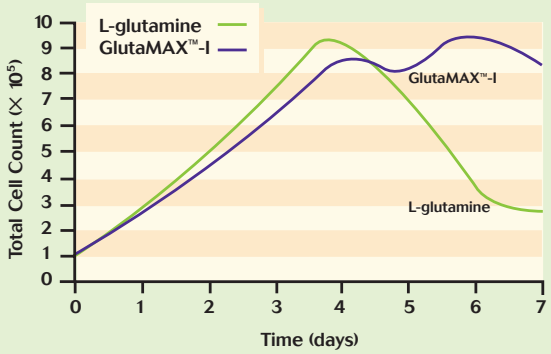

Figure 7. MDBK cells were seeded at approximately 1 × 10^5 cells/flask in D-MEM with 10% FBS and L-glutamine or GlutaMAX™-I in 25 cm^2 T-flasks.

Common Cell Lines Cultured with GlutaMAX™-I

MDBK	Bovine Kidney
MDCK	Canine Kidney
HELA	Human Ovary
Per. C6	Human Embryonic Retinoblastoma
293	Human Embryonic Kidney
AE-1	Mouse Hybridoma
3D9	Mouse Hybridoma
CHO	Hamster Ovary
BHK	Hamster Kidney

For a complete list of citations, go to www.invitrogen.com

Get What You Need for Better Cell Culture

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From the world's largest manufacturer of products for cell culture, GIBCO™ media, sera, reagents, and technical support have set the global standard for over 40 years.

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You get what you need for better cell culture.

References

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2. Hassell, T., Gleave, S., and Butler, M. (1991) Growth Inhibition in Cell Culture. *Applied Biochemistry and Biotechnology* **30**, 30–41.
3. Yang, M. and Butler, M. (2002) Effects of Ammonia and Glucosamine on the Heterogeneity of Erythropoietin Glycoforms. *Biotechnology Progress* **18**, 129–138.
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5. Christie, A. and Butler, M. (1994) Growth and Metabolism of a Murine Hybridoma in Cultures Containing Glutamine-based Dipeptides. *FOCUS*® **16**, 1, 9.
6. Brand, K., Feki, W., Hintzentern, J., von Langer, K., Luppa, P., and Schroener, C. (1989) *Metabolism* **38**, 29.

For a free sample of GlutaMAX™ Media or GlutaMAX™-I Supplement, call Cell Culture Technical Services, 1-800-955-6288.

GlutaMAX™ Media

ORDERING INFORMATION

Description	Classical Media With L-Glutamine Cat. No.	Classical Media Without L-Glutamine Cat. No.	Size	GlutaMAX™ Media Cat. No.	GlutaMAX™ Media Size
Dulbecco's Modified Eagle Medium (D-MEM) (1X), liquid Low glucose, contains sodium pyruvate.	11885-076 11885-084 11885-092		1,000 ml 500 ml 10 × 500 ml	**10567-014**	500 ml
Dulbecco's Modified Eagle Medium (D-MEM) (1X), liquid High glucose, contains sodium pyruvate.	11995-040 11995-081 11995-065 11995-073	 10313-021 	1,000 ml 6 × 1,000 ml 500 ml 10 × 500 ml	**10569-010**	500 ml
Dulbecco's Modified Eagle Medium (D-MEM) (1X), liquid High glucose, contains no sodium pyruvate.	11965-084 11965-126 11965-092 11965-118	11960-051 11960-077 11960-044 11960-069	1,000 ml 6 × 1,000 ml 500 ml 10 × 500 ml	**10566-016**	500 ml
Dulbecco's Modified Eagle Medium (D-MEM) (1X), liquid High glucose, contains HEPES buffer, but no sodium pyruvate.	12430-047 12430-054 12430-062		1,000 ml 500 ml 10 × 500 ml	**10564-011**	500 ml
D-MEM/F-12, (1X) liquid, 1:1	11320-033		500 ml	**10565-018**	500 ml
F-12 Nutrient Mixture, (Ham) (1X), liquid	11765-047 11765-070 11765-054 11765-062		1,000 ml 6 × 1,000 ml 500 ml 10 × 500 ml	**31765-035**	500 ml
Iscove's Modified Dulbecco's Medium (IMDM) (1X), liquid	12440-046 12440-053 12440-061		1,000 ml 500 ml 10 × 500 ml	**31980-030**	500 ml
Minimum Essential Medium (MEM) alpha (1X), liquid Contains no ribonucleosides or deoxyribonucleosides.	12561-049 12561-056		1,000 ml 500 ml	**32561-037**	500 ml
Minimum Essential Medium (MEM) alpha (1X), liquid Contains ribonucleosides and deoxyribonucleosides.	12571-048 12571-063 12571-071		1,000 ml 500 ml 10 × 500 ml	**32571-036**	500 ml
Minimum Essential Medium (MEM), liquid Contains Earle's Salts.	11095-072 11095-080 11095-098	11090-073 11090-081 11090-099	1,000 ml 500 ml 10 × 500 ml	**41090-036**	500 ml
Minimum Essential Medium (MEM), liquid Contains Earle's Salts and HEPES buffer.		12360-038	500 ml	**42360-032**	500 ml
Opti-MEM® I Reduced-Serum Medium (1X), liquid	31985-062 31985-070 31985-088		100 ml 500 ml 10 × 500 ml	**51985-034**	500 ml
RPMI Medium 1640 (1X), liquid	11875-085 11875-135 11875-093 11875-119 11875-101 11875-127	21870-084 21870-076 21870-092 	1,000 ml 6 × 1,000 ml 500 ml 10 × 500 ml 100 ml 20 × 100 ml	**61870-036**	500 ml
RPMI Medium 1640 (1X), liquid Contains HEPES buffer.	22400-071 22400-089 22400-105		1,000 ml 500 ml 10 × 500 ml	**72400-047**	500 ml

Reagents	Cat. No.	Size	GlutaMAX™-I Supplement* Cat. No.	GlutaMAX™-I Supplement* Size
L-Glutamine-200 mM (100X), liquid	25030-149 25030-081	20 ml 100 ml	**35050-061**	100 ml

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GIBCO™ cell culture

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