

life

gibco | cell culture
by *life* technologies™



GlutaMAX™ media

healthier cells live longer

life
technologies™

get the most from your cell cultures with GlutaMAX™ media

- Increase media stability
- Minimize toxic ammonia buildup
- 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 by-product, 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 nontoxic 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 buildup even during long-term culture (Figures 2 and 3). Extremely stable in aqueous solution, the dipeptide does not degrade in storage or incubation.

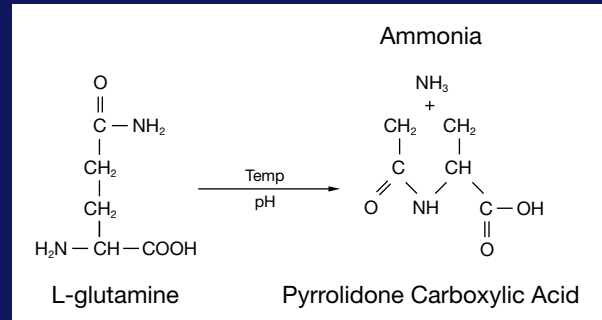


Figure 1. L-glutamine spontaneously decomposes into ammonia and pyrrolidone carboxylic acid at a rate dependent on pH and temperature [1].

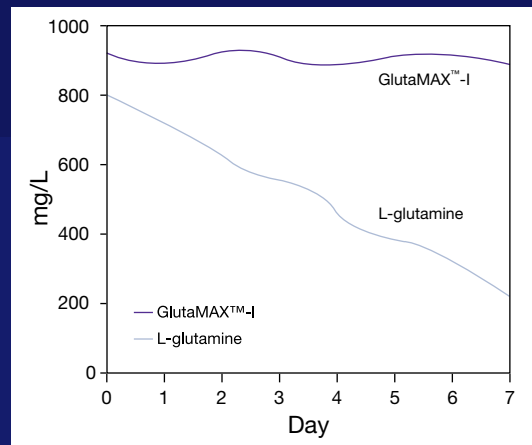


Figure 2. Stability of GlutaMAX™-I vs. L-glutamine in DMEM. DMEM was supplemented with GlutaMAX™-I or L-glutamine, aliquoted into vials, and stored at 37°C. Samples were taken daily and frozen at -20°C. Levels of GlutaMAX™-I and L-glutamine were determined by HPLC.

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 concentrations. The result is efficient energy metabolism and 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 buildup, and maximize cell performance. Get the most from your cell cultures with GlutaMAX™ media.

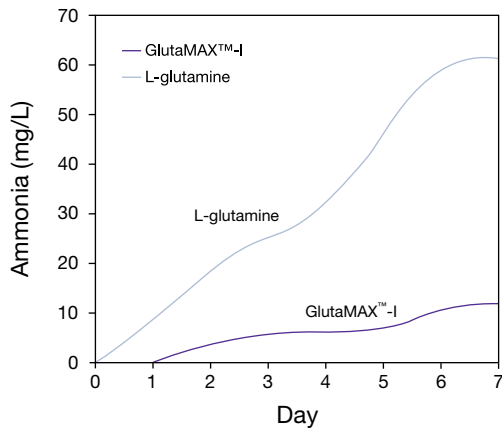


Figure 3. Ammonia levels in supplemented media. DMEM was supplemented with GlutaMAX™-I or L-glutamine, aliquoted into vials and stored at 37°C. Samples were taken daily and frozen at -20°C. Levels of ammonia were determined by HPLC.

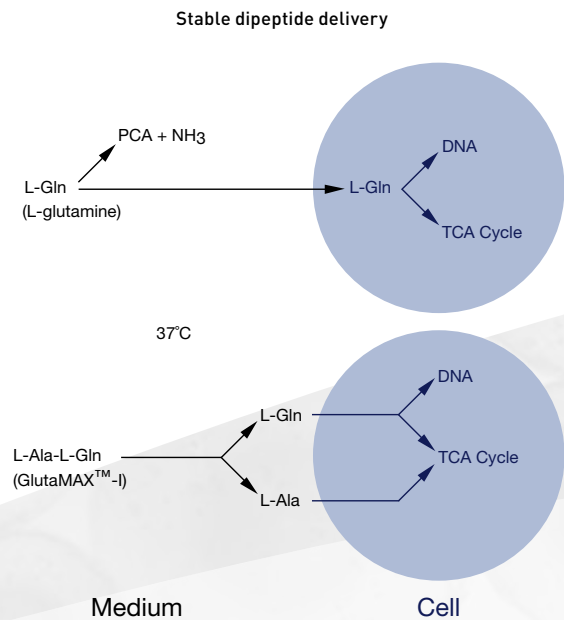


Figure 4. Controlled delivery of L-glutamine from media to cells in culture.

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 IgG1 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 DMEM 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 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 DMEM, MEM, IMDM, RPMI, Opti-MEM® media, and others. For details, see the insert in this brochure or the Gibco® catalog.

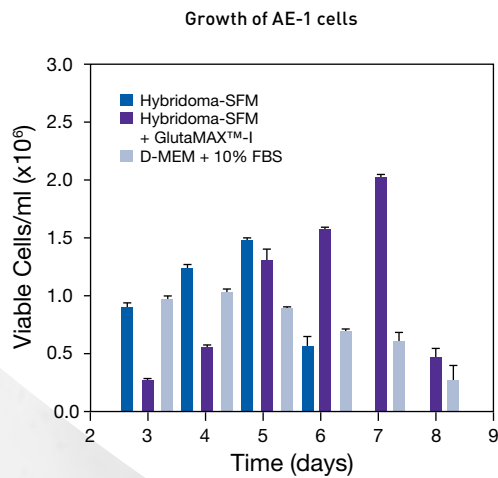


Figure 5. Cell growth. AE-1 mouse myeloma cells were seeded at 1×10^5 cells/mL. Samples were taken daily after 3 days and evaluated in triplicate for cell density. Cell viability was determined by trypan blue exclusion. Cell density continued to increase in samples containing GlutaMAX™-I past the point when L-glutamine-containing samples decreased in cell density.

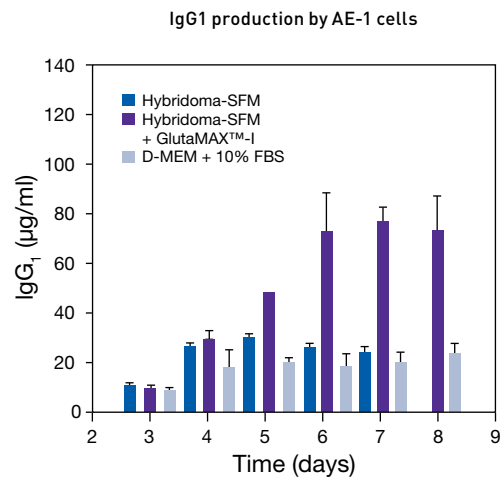


Figure 6. IgG1 production. The samples from Figure 5 were also examined by ELISA for IgG1 production. GlutaMAX™-I-containing samples outperformed L-glutamine-containing samples.

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

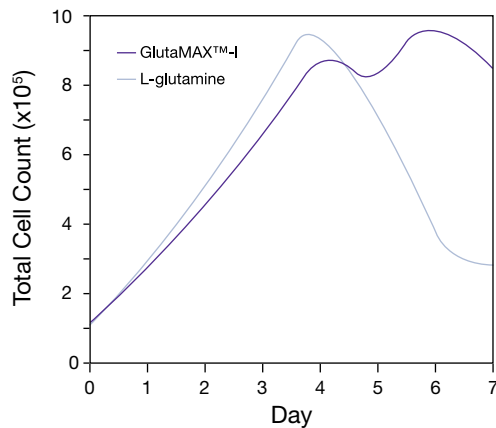


Figure 7. Growth of MDBK cells in DMEM supplemented with L-glutamine or GlutaMAX™-I and 10% FBS. MDBK cells were seeded at approximately 1×10^5 cells/flask in DMEM with 10% FBS and L-glutamine or GlutaMAX™-I in 25 cm² T-flasks.

Common cell lines cultured with GlutaMAX™-I

Cell line	Source
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.

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You get what you need for better cell culture and reproducible research results.

References

1. Tritsch GL, Moore GE (1962) Spontaneous decomposition of glutamine in cell culture media. *Exp Cell Res* 28:360–364.
2. Hassell T, Gleave S, Butler M (1991) Growth inhibition in cell culture. *Appl Biochem Biotechnol* 30:30–41.
3. Yang M, Butler M (2002) Effects of ammonia and glucosamine on the heterogeneity of erythropoietin glycoforms. *Biotechnol Prog* 18:129–138.
4. Yang M, Butler M (2000) Effects of ammonia on the glycosylation of human recombinant erythropoietin in culture. *Biotechnol Prog* 16:751–759.
5. Christie A, 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, Lupp P, Schroener C (1989) *Metabolism* 38:29.

For a free sample of GlutaMAX™ media or GlutaMAX™-I Supplement, call Cell Culture Technical Services at 1.800.955.6288.

GlutaMAX™ media ordering information

Description	Classical media	Classical media	GlutaMAX™ media		
	with L-glutamine	without L-glutamine	Cat. No.	Size	
	Cat. No.	Cat. No.			
Dulbecco's Modified Eagle Medium (DMEM) (1X), liquid Low glucose, contains sodium pyruvate	11885-076		1,000 mL	10567-014	500 mL
	11885-084		500 mL		
	11885-092		10 x 500 mL		
Dulbecco's Modified Eagle Medium (DMEM) (1X), liquid High glucose, contains sodium pyruvate	11995-040		1,000 mL	10569-010	500 mL
	11995-081		6 x 1,000 mL		
	11995-065	10313-021	500 mL		
	11995-073		10 x 500 mL		
Dulbecco's Modified Eagle Medium (DMEM) (1X), liquid High glucose, contains no sodium pyruvate	11965-084	11960-051	1,000 mL	10566-016	500 mL
	11965-126	11960-077	6 x 1,000 mL		
	11965-092	11960-044	500 mL		
	11965-118	11960-069	10 x 500 mL		
Dulbecco's Modified Eagle Medium (DMEM) (1X), liquid High glucose, contains HEPES buffer but no sodium pyruvate	12430-047		1,000 mL	10564-011	500 mL
	12430-054		500 mL		
	12430-062		10 x 500 mL		
DMEM/F-12, (1X) liquid, 1:1	11320-033		500 mL	10565-018	500 mL
F-12 Nutrient Mixture (Ham), (1X), liquid	11765-047		1,000 mL	31765-035	500 mL
	11765-070		6 x 1,000 mL		
	11765-054		500 mL		
	11765-062		10 x 500 mL		
Iscove's Modified Dulbecco's Medium (IMDM) (1X), liquid	12440-046		1,000 mL	31980-030	500 mL
	12440-053		500 mL		
	12440-061		10 x 500 mL		
Minimum Essential Medium (MEM) alpha (1X), liquid Contains no ribonucleosides or deoxyribonucleosides	12561-049		1,000 mL	32561-037	500 mL
	12561-056		500 mL		
Minimum Essential Medium (MEM) alpha (1X), liquid Contains ribonucleosides and deoxyribonucleosides	12571-048		1,000 mL	32571-036	500 mL
	12571-063		500 mL		
	12571-071		10 x 500 mL		
Minimum Essential Medium (MEM), liquid Contains Earle's Salts	11095-072	11090-073	1,000 mL	41090-036	500 mL
	11095-080	11090-081	500 mL		
	11095-098	11090-099	10 x 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		100 mL	51985-034	500 mL
	31985-070		500 mL		
	31985-088		1,000 mL		
RPMI Medium 1640 (1X), liquid	11875-085	21870-084	1,000 mL	61870-036	500 mL
	118975-135		6 x 1,000 mL		
	11875-093	21870-076	500 mL		
	11875-119	21870-092	10 x 500 mL		
	11875-101		100 mL		
	11875-127		20 x 100 mL		
RPMI Medium 1640 (1X), liquid Contains HEPES buffer	22400-071		1,000 mL	72400-047	500 mL
	22400-089		500 mL		
	22400-105		10 x 500 mL		

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

* This product is for research use, and where appropriate, as raw material components in further cell culture manufacturing applications. It is not intended for human or animal diagnostic, therapeutic, or other clinical uses, unless otherwise stated.

Maximize your cell cultures with GlutaMAX™ media

Increase media stability, minimize toxic ammonia buildup, and maximize cell performance. Use GlutaMAX™ media to get the most from your cell cultures.

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