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) [1], generating ammonia as a by-product, which is toxic to the cells [2]. This 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

Media with Gibco™ GlutaMAX™ Supplement are standard cell culture formulations that contain a stabilized form of L-glutamine, the dipeptide L-alanyl-L-glutamine, that prevents degradation and buildup of ammonia even during long-term culture (Figures 2 and 3). The dipeptide, due to its extreme stability in aqueous solution, does not degrade in storage or incubation. This allows:

- Increased media stability
- Minimized toxic ammonia buildup
- Maximized cell performance

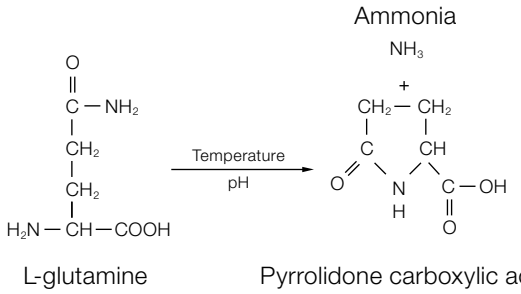

Figure 1. L-glutamine spontaneously decomposes into ammonia and pyrrolidone carboxylic acid at a rate dependent on pH and temperature [1].

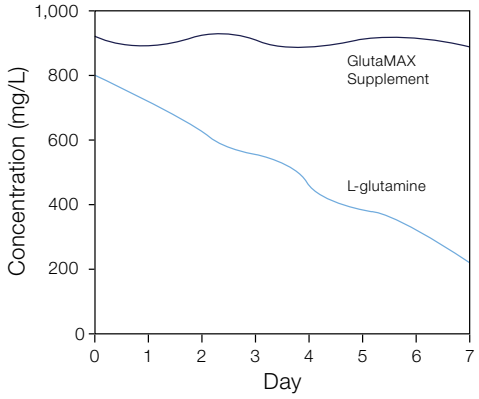

Figure 2. L-glutamine degrades faster than GlutaMAX Supplement in media at 37˚C. DMEM was supplemented with GlutaMAX Supplement or L-glutamine, dispensed into vials, and stored at 37°C. Samples were taken daily and frozen at –20°C. Levels of GlutaMAX Supplement and L-glutamine were determined by HPLC.

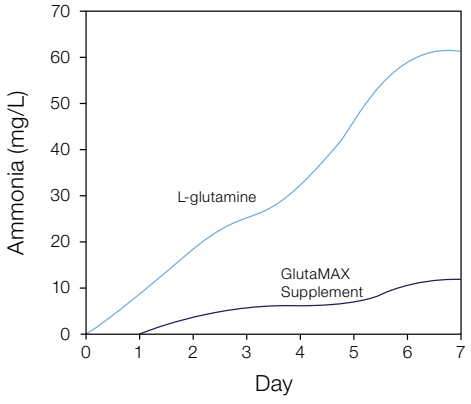

Figure 3. Ammonia levels in supplemented media. DMEM was supplemented with GlutaMAX Supplement or L-glutamine, dispensed into vials, and stored at 37°C. Samples were taken daily and frozen at –20°C. Levels of ammonia were determined by HPLC.

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Extend the life of your cells

GlutaMAX Supplement can also extend cell culture life, which may reduce the number of times the cells must be passaged. Figure 4 compares MDBK cells cultured in DMEM with 10% FBS and L-glutamine or GlutaMAX Supplement. Cells cultured in GlutaMAX Supplement 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].

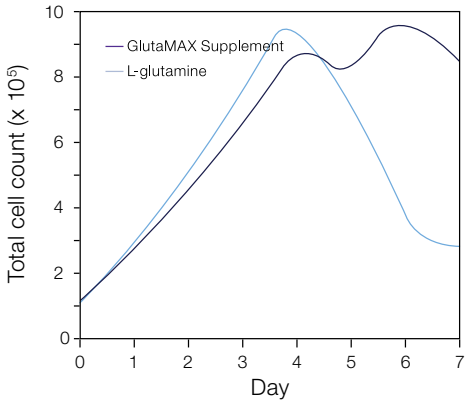

Figure 4. Growth of MDBK cells with L-glutamine versus GlutaMAX Supplement. MDBK cells were seeded at approximately 1 x 10^5 cells/flask in DMEM with 10% FBS and L-glutamine or GlutaMAX Supplement in 25 cm^2 T-flasks.

Choose from many formulations

We offer many widely used liquid media formulations in which the GlutaMAX dipeptide substitutes for L-glutamine. They include Gibco™ DMEM, MEM, IMDM, RPMI, Opti-MEM™ media, and others. For details, go to **thermofisher.com/glutamax**.

Do it yourself with GlutaMAX Supplement

You can purchase the GlutaMAX dipeptide as a stand-alone supplement. Supplied as a 200 mM solution, GlutaMAX Supplement can be used as a direct substitute for L-glutamine at equimolar concentrations in your current cell culture media formulations.

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

Applications for GlutaMAX Supplement

GlutaMAX Supplement and media with GlutaMAX Supplement are suitable for both adherent and suspension cultures of mammalian cells, 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 passaged over time, and toxicity testing)
- Culture systems sensitive to ammonia (e.g., high-density bioreactors)

Common cell lines cultured with GlutaMAX Supplement

Cell line	Source
MDBK	Bovine kidney
MDCK	Canine kidney
HeLa	Human ovary
PER.C6	Human embryonic retinoblastoma
HEK293	Human embryonic kidney
AE-1	Mouse hybridoma
3D9	Mouse hybridoma
CHO	Chinese hamster ovary
BHK	Baby hamster kidney

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. The effect of lactate and ammonia. *Appl Biochem Biotechnol* 30:29–41.
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) Glutamine-based dipeptides are utilized in mammalian cell culture by extracellular hydrolysis catalyzed by a specific peptidase. *J Biotechnol* 37:277–90.

Ordering information

Description	Classical medium with L-glutamine	Classical medium without L-glutamine		Medium with GlutaMAX Supplement	
	Cat. No.	Cat. No.	Quantity	Cat. No.	Quantity
Dulbecco's Modified Eagle Medium (DMEM) (1X), liquid Low glucose, contains sodium pyruvate	11885-076 11885-084 11885-092		1,000 mL 500 mL 10 x 500 mL	10567-014 (in EU 21885-025)	500 mL
Dulbecco's Modified Eagle Medium (DMEM) (1X), liquid High glucose, contains sodium pyruvate	11995-040 11995-081 11995-065 11995-073	 10313-021 	1,000 mL 6 x 1,000 mL 500 mL 10 x 500 mL	10569-010 (in EU 31966-021)	500 mL
Dulbecco's Modified Eagle Medium (DMEM) (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 x 1,000 mL 500 mL 10 x 500 mL	10566-016 (in EU 61965-026)	500 mL
Dulbecco's Modified Eagle Medium (DMEM) (1X), liquid High glucose, contains HEPES buffer but no sodium pyruvate	12430-047 12430-054 12430-062		1,000 mL 500 mL 10 x 500 mL	10564-011 (in EU 32430-027)	500 mL
DMEM/F-12 (1X), liquid, 1:1	11320-033		500 mL	10565-018 (in EU 31331-028)	500 mL
Ham's F-12 Nutrient Mix (1X), liquid	11765-047 11765-070 11765-054 11765-062		1,000 mL 6 x 1,000 mL 500 mL 10 x 500 mL	31765-035 (in EU 31765-027)	500 mL
Iscove's Modified Dulbecco's Medium (IMDM) (1X), liquid	12440-046 12440-053 12440-061		1,000 mL 500 mL 10 x 500 mL	31980-030 (in EU 31980-022)	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 (in EU 32561-029)	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 x 500 mL	32571-036 (in EU 32571-028)	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 x 500 mL	41090-036 (in EU 41090-028)	500 mL
Minimum Essential Medium (MEM), liquid Contains Earle's salts and HEPES buffer		12360-038	500 mL	42360-032 (in EU 42360-024)	500 mL
Opti-MEM I Reduced-Serum Medium (1X), liquid	31985-062 31985-070 31985-088		100 mL 500 mL 1,000 mL	51985-034 (in EU 51985-026)	500 mL
RPMI 1640 Medium (1X), liquid	11875-085 11875-135 11875-093 11875-119 11875-101 11875-127	21870-084 21870-076 21870-092 	1,000 mL 6 x 1,000 mL 500 mL 10 x 500 mL 100 mL 20 x 100 mL	61870-036 (in EU 61870-010)	500 mL
RPMI 1640 Medium (1X), liquid Contains HEPES buffer	22400-071 22400-089 22400-105		1,000 mL 500 mL 10 x 500 mL	72400-047 (in EU 72400-021)	500 mL

			GlutaMAX Supplement*	
Reagent	Cat. No.	Quantity	Cat. No.	Quantity
L-Glutamine 200 mM (100X), liquid	25030-149 25030-081	20 mL 100 mL	35050-061 (in EU 35050-038)	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.

Find out how to maximize your cell cultures with GlutaMAX Supplement at **thermofisher.com/glutamax**