LiposoMore

LiposoMore® – Advanced Liposomal Ingredients
Delivering Premium Nutrition Through Science & Innovation

A Liposomal Brand Exclusively Owned by
Joyful Nutritional Supply Co.,ltd.

Technical Data Sheet: Liposomal Magnesium Citrate Powder (LiposoMore™-MgC)

Technical Identity and Product Description

Liposomal Magnesium Citrate Powder, marketed under the premium brand name LiposoMore™-MgC, is an advanced, high-bioavailability mineral ingredient designed for use in food supplements and clinical nutrition.[1] Magnesium is a vital mineral that serves as an enzymatic cofactor in more than 300 biochemical reactions in the human body, playing a central role in neuromuscular coordination, cellular energy production, cardiovascular regulation, and bone mineralization.[3] Despite its physiological importance, standard oral magnesium supplements frequently suffer from poor intestinal absorption and are limited by low cellular bioavailability.[2] Unabsorbed magnesium ions remaining in the gastrointestinal tract exert osmotic pressure, drawing water into the intestinal lumen and causing common side effects such as abdominal cramping, bloating, and laxative effects—a phenomenon widely referred to as the magnesium flush.[2]

To overcome these pharmacokinetic and tolerability challenges, LiposoMore™-MgC utilizes microencapsulation technology to coat purified magnesium citrate with a stable phospholipid bilayer.[1] Phosphatidylcholine, the primary lipid constituent derived from non-GMO sunflower or soy lecithin, forms spherical vesicles that encapsulate the mineral core.[6] This liposomal structure shields the active magnesium citrate from the highly acidic gastric environment and digestive enzymes.[3] Once in the small intestine, the phospholipid membrane facilitates direct endocytosis and membrane fusion with the enterocyte cell walls of the intestinal mucosa, bypassing the conventional, saturable protein-channel transport pathways.[4]

Furthermore, the raw material is manufactured using Dietary Fiber Stabilized (DFS) Technology™.[2] This patent-filed process incorporates prebiotic fibers into the liposomal matrix, providing structural support to the delicate lipid bilayers during dehydration and spray-drying.[2] This advanced formulation technique prevents the collapse or leakage of the liposomes, yielding a highly stable, free-flowing, and water-dispersible powder that is gentle on the stomach and possesses excellent taste-masking properties.[2]

The manufacturing facility is operated by Joyful Nutritional Supply Co., Ltd., located at No. 2045

Songbai Road, Baoan District, Shenzhen, China.[1] This state-of-the-art facility is certified under the FSSC 22000 Food Safety System and features an analytical laboratory certified by the China National Accreditation Service for Conformity Assessment (CNAS).[16]

Certified Batch Specifications and Analytical Standards

To guarantee the highest level of batch-to-batch consistency and purity, every production lot of LiposoMore™-MgC is subjected to strict quality control assessments in accordance with United States Pharmacopeia (USP) guidelines and internal in-house standards.[1] The following table presents the official specification profile alongside the actual laboratory results for Batch No. JN-20260201506, as documented under Report No. JN-20260222008.[1]

Analysis Parameter	Specification Standard	Batch Result	Test Method Reference
Product Brand Name	LiposoMore™-MgC	Confirmed	Visual / Documentation
Batch Number	JN-20260201506	Confirmed	Documentation
Manufacturing Date	2026.02.15	Confirmed	Documentation
Retest Date	2028.02.15	Confirmed	Documentation
Batch Quantity	1000 KGS	Confirmed	Documentation
Appearance	White Powder	Pass	USP $<631>$ Visual Examination

Odor	Odorless	Pass	USP $<631>$ Organoleptic
Assay (Elemental Magnesium)	**11.6-12.32%**	12.10%	USP $<731>$ Complexometric Titration
Assay (Magnesium Citrate)	**80%-85%**	83.44%	USP $<731>$ Complexometric Titration
Loss on Drying	$\leq 6.0\%$	3.8%	USP $<731>$ Gravimetric
Total Heavy Metals	≤ 10 ppm	< 10 ppm	USP ICP-MS
Lead (Pb)	≤ 3 ppm	< 3 ppm	USP $<233>$ ICP-MS
Mercury (Hg)	≤ 0.1 ppm	< 0.1 ppm	USP $<233>$ ICP-MS
Cadmium (Cd)	≤ 1.0 ppm	< 1.0 ppm	USP $<233>$ ICP-MS
Arsenic (As)	≤ 1.0 ppm	< 1.0 ppm	USP $<233>$ ICP-MS
Total Plate Count	≤ 1000 cfu/g	< 100 cfu/g	USP $<61>$ Microbial Enumeration

Molds & Yeasts	≤ 100 cfu/g	< 10 cfu/g	USP $<61>$ Microbial Enumeration
Escherichia coli	Negative in 20 g	Negative	USP $<62>$ Microbial Examination
Salmonella spp.	Negative in 25 g	Negative	USP $<62>$ Microbial Examination
Staphylococcus aureus	Negative in 25 g	Negative	USP $<62>$ Microbial Examination
Particle Size	$\geq 95\%$ pass 80 mesh	Pass	USP $<786>$ Sieve Analysis
Particle Size Distribution (PSD)	$> 90\%$ pass 80 mesh	Pass	USP $<786>$ Sieve Analysis
Bulk Density	Report Value	$350 - 550$ g/L *(typical range)*	USP $<616>$ Bulk Density

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Market Differentiators and Commercial Grades

The dietary supplement raw material market offers different grades of liposomal magnesium citrate, allowing formulators to choose the ideal concentration based on the targeted dosage form and application.[2] LiposoMore™-MgC represents a premium, high-potency grade optimized for maximizing active mineral content per dose, whereas standard commercial grades are often optimized primarily for rapid dispersion in liquid applications.[1]

Technical Parameter	Premium High-Potency Grade (LiposoMore™-MgC)	Standard Dispersible Grade (e.g., LipoMg™)
Elemental Magnesium Assay	**11.6-12.32%**	**5.0%-5.5%**
Magnesium Citrate Content	**80%-85%** [1]	Approximately 35% [13]
Primary Stabilizing Agent	Prebiotic Fiber / DFS Technology™ [2]	Inulin / Silica Carrier [12]
Reconstitution Profile	Semi-translucent to turbid liposomal emulsion [18]	Completely water-dispersible, clear to semi-clear [13]
Typical Target Applications	Capsules, Tablets, Compressible Blends [21]	Powder Sachets, Functional Beverages, Gummies [5]

Physicochemical Characteristics and Colloidal Attributes

Understanding the physical properties of LiposoMore™-MgC is critical for both downstream food supplement formulation and dry-powder handling.[23] Sieve analysis shows that at least 95% of the powder passes through an 80-mesh screen.[1] This ensures a highly uniform particle size distribution, reducing the risk of active-ingredient segregation during dry blending and optimizing flowability through commercial capsule-filling machines.[1]

When reconstituted in an aqueous medium, the liposomes exhibit strong colloidal stability.[26] The particles show a consistent size distribution, typically centered between $100\ \text{nm}$ and $300\ \text{nm}$.[18] The electrostatic stability of the dispersed liposomes is validated by their zeta potential, which typically measures around $-20.43\ \text{mV}$ or wider.[24] This negative net charge creates electrostatic repulsion between the vesicles, preventing aggregation, sedimentation, or phase separation in liquid formulations over time.[18]

The bulk density of the powder is optimized to support volumetric dosing, allowing seamless

integration into high-speed manufacturing lines.[1] Additionally, the low moisture content of $\leq 6.0\%$ (with Batch JN-20260201506 demonstrating a mere 3.8% loss on drying) is highly critical.[1] Maintaining a low water activity level prevents the hydrolysis of the ester-linked hydrocarbon chains within the phosphatidylcholine bilayer, preserving the liposomal structure during dry-state storage.[1]

Enhanced Bioavailability and Cellular Mechanism

The superior biological efficacy of LiposoMore™-MgC is directly attributed to the cellular mechanisms enabled by its lipid bilayer structure.[3] Conventional oral magnesium salts rely on active and passive ion transport mechanisms in the gastrointestinal tract, which are easily saturated and heavily influenced by the presence of dietary inhibitors or competing minerals.[4]

Conventional Divalent Pathway:
[Ionic Magnesium (Mg2+)] ---> ---> [Low Absorption (4-16%)] --->

Liposomal Membrane Fusion Pathway:
[Liposomal Magnesium Citrate] ---> [Enterocyte Membrane Fusion / Endocytosis] ---> [High Absorption (20-30%+)] --->

By encapsulating magnesium citrate within a biomimetic phospholipid envelope, the mineral is protected from reacting with dietary phytic acid, oxalic acid, or other minerals in the gut.[4] The liposomes travel intact through the stomach and merge directly with the enterocytes of the small intestinal lining.[3] Caco-2 human intestinal epithelial cell monolayer permeability studies have demonstrated that this liposomal delivery system achieves nearly $2\times$ higher cellular permeability compared to standard non-liposomal mineral forms.[2]

Clinical and real-world evaluations confirm that this increased rate of absorption (typically reaching $20\% - 30\%$ or higher, compared to the $4\% - 16\%$ typical of standard mineral oxides or simple salts) allows formulators to achieve therapeutic efficacy at lower oral doses.[4] This enhanced absorption profile also prevents gastrointestinal side effects like diarrhea, making it highly suitable for individuals with sensitive digestive tracts, irritable bowel syndrome, or chronic mineral deficiencies.[3]

Industrial Manufacturing Process and Critical Quality

Controls

The production of LiposoMore™-MgC is executed using advanced industrial-scale equipment and precise thermodynamic controls to achieve high encapsulation efficiency, typically exceeding $80\% - 90\%$.[6]

1. **Phase Dissolution and Lipid Assembly:** Phosphatidylcholine derived from non-GMO sunflower or soy lecithin is dissolved in a pharmaceutical-grade, polar organic solvent system (predominantly ethanol) to form a homogeneous lipid phase.[6] Simultaneously, food-grade anhydrous magnesium citrate is dissolved in demineralized water to create the aqueous phase.[1]
2. **High-Shear Emulsification:** The lipid phase is slowly introduced into the aqueous mineral solution under high-shear mixing.[6] This process causes the phospholipids to self-assemble into crude multilamellar liposomes, encapsulating the dissolved magnesium citrate within their hydrophilic cores.[6]
3. **Microfluidization and Vesicle Sizing:** The crude emulsion is passed through a high-pressure homogenizer or microfluidizer.[6] The application of intensive shear and cavitation forces breaks the larger vesicles down into highly uniform, nano-sized oligolamellar or unilamellar vesicles, typically measuring between $100\ \text{nm}$ and $300\ \text{nm}$.[6]
4. **Purification and Concentration:** Residual solvents and unencapsulated ionic magnesium are removed via tangential flow filtration or dialysis, ensuring that only highly pure, fully encapsulated liposomal complexes proceed to the drying phase.[6]
5. **DFS Matricization and Dehydration:** To convert the liquid liposomal dispersion into a stable, dry powder without fracturing the delicate lipid bilayers, prebiotic dietary fibers and helper cryoprotectants are introduced into the system.[2] The mixture undergoes rapid spray-drying or lyophilization.[24] The cryoprotectants vitrify to form a protective, glassy matrix that stabilizes the liposome structures during water removal.[31]
6. **Milling, Sifting, and Inert Packaging:** The dry powder is gently milled and passed through an 80-mesh sieve to ensure a uniform particle size distribution.[1] The finished powder is vacuum-packaged under an inert nitrogen headspace to prevent lipid oxidation and moisture absorption.[24]

Formulation Compatibility, Synergy, and Applications

LiposoMore™-MgC is a highly versatile raw material suitable for a wide range of dietary supplement formulations.[5] Its excellent taste-masking properties and gentle digestive profile make it an ideal choice for both standalone products and complex, multi-ingredient blends.[3]

Formulating Parameter	Technical Recommendation
Synergistic Co-factors	Vitamin B_6 (as Pyridoxal-5-Phosphate) to enhance cellular transport and neurotransmitter synthesis
Prebiotic Enrichment	Inulin or chicory root fiber to improve digestive health and support the liposomal matrix
Mineral Complexing	Can be blended with other liposomal minerals (e.g., Magnesium Bisglycinate, Malate, or Taurate)
Lubricants & Flow Aids	Silicon Dioxide ($\leq$) and Magnesium Stearate to optimize powder flow and reduce static
Bulking Agents	Rice Flour, microcrystalline cellulose, or Isomalt to adjust active fill weight in capsules
Target Capsule Types	Vegetarian cellulose (HPMC) or acid-resistant hypromellose capsules

Downstream formulators should note that when incorporating LiposoMore™-MgC into liquid preparations, the formulation pH should be kept as close to neutral ($\text{pH } 6.0 - 7.0$) as possible.[27] Phospholipids containing ester-linked hydrocarbon chains are highly susceptible to acid- and base-catalyzed hydrolysis.[27] Additionally, avoid introducing high-shear mixing or freezing temperatures during finished liquid product manufacturing, as these mechanical stresses can rupture the protective lipid vesicles and lead to premature mineral leakage.[27]

Stability, Packaging, Handling, and Storage Protocols

Moisture and Chemical Vulnerabilities

The primary degradation pathways for liposomal powders are hydrolytic cleavage and lipid oxidation.[27] Exposure to moisture triggers the hydrolysis of the ester bonds in the phosphatidylcholine molecules, yielding free fatty acids and lysophospholipids.[27] Lysophospholipids act as natural detergents that solubilize and disrupt the liposomal membrane, leading to structural collapse and loss of the encapsulated core ingredients.[27] Furthermore, exposure to oxygen and ultraviolet light induces the peroxidation of unsaturated

fatty acids within the lecithin bilayer, resulting in rancid odors and compromised bioavailability.[28]

Storage Requirements

To maintain the structural integrity, particle size distribution, and biological efficacy of LiposoMore™-MgC over its verified 24-month shelf life, store the raw material in compliance with the following protocols:

- **Temperature Control:** Store the material in a cool, dry warehouse space, keeping temperatures below $25^{\circ}\mathrm{C}$.[18] For long-term preservation of chemical purity over several years, storage in refrigerated conditions ($2^{\circ}\mathrm{C} - 8^{\circ}\mathrm{C}$) is recommended.[25]
- **Humidity and Light Control:** Keep the storage area well-ventilated, maintaining a relative humidity (RH) below 60%.[23] Ensure the product is shielded from direct sunlight, UV exposure, and heat sources.[1]
- **Inert Atmosphere:** Keep the containers tightly sealed.[18] Once opened, purge the headspaces with nitrogen or argon gas to displace oxygen before resealing.[25]

Packaging Configurations

For bulk distribution, LiposoMore™-MgC is packaged in double-walled, food-grade polyethylene inner bags, heat-sealed with an active desiccant packet to prevent moisture ingress.[1] These inner bags are housed in durable fiber drums or high-density polyethylene (HDPE) drums, with standard bulk packaging weights of $1\ \mathrm{kg}$, $5\ \mathrm{kg}$, and $25\ \mathrm{kg}$.[13]

Manufacturer and Technical Support Contact Information

For technical inquiries, safety data sheets (SDS), regulatory dossier requests, or bulk ordering, contact the manufacturer's technical services department:

- **Manufacturer Name:** Joyful Nutritional Supply Co., Ltd. [1]
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