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

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

Technical Dossier and Data Sheet: LiposoMore™Mg (Liposomal Magnesium Oxide)

Product Name: LiposoMore™Mg
Chemical Description: Microencapsulated Magnesium Oxide in Phospholipid Bilayer
Manufacturer: Joyful Nutritional Supply Co., Ltd.
Document Type: Comprehensive Technical Data Sheet (TDS) & Scientific Report
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1. Executive Summary and Brand Identity

1.1 The Evolution of Mineral Supplementation

The global nutraceutical landscape is currently undergoing a significant transformation, moving away from commoditized, low-bioavailability mineral salts toward advanced delivery systems that mimic biological transport mechanisms. Magnesium, often termed the "forgotten electrolyte," is central to this shift. While Magnesium Oxide (MgO) has historically been the most commercially viable form of magnesium due to its high elemental density, it has been plagued by poor aqueous solubility and a reputation for causing gastrointestinal distress.

LiposoMore™Mg represents the pinnacle of this evolutionary curve. By employing advanced liposomal encapsulation technology, Joyful Nutritional Supply Co., Ltd. has engineered a raw material that bridges the gap between the high potency of inorganic magnesium and the superior bioavailability of organic chelates. This technical dossier serves as a comprehensive resource for formulators, quality assurance professionals, and product managers, detailing the physicochemical properties, stability profiles, and regulatory compliance of LiposoMore™Mg.

1.2 Supplier Profile: Joyful Nutritional Supply Co., Ltd.

Joyful Nutritional Supply Co., Ltd. operates at the forefront of the functional ingredient sector, distinguishing itself through a commitment to "Joyful" service—a philosophy rooted in transparency, reliability, and technical excellence. The company has established a robust supply chain for high-value nutritional ingredients, with a particular specialization in liposomal and microencapsulated technologies.

The brand **LiposoMore™** is not merely a trade name but a declaration of the product's value proposition: "More" absorption, "More" stability, and "More" functional efficacy. Joyful Nutritional Supply Co., Ltd. leverages state-of-the-art manufacturing facilities that adhere to **Good Manufacturing Practices (GMP)** and **ISO 22000** standards, ensuring that every batch of LiposoMore™Mg meets the rigorous safety and quality demands of the international market.

1.3 Product Identification and Nomenclature

To facilitate global trade and regulatory registration, LiposoMore™Mg is identified by the following standardized codes:

Identifier	Value	Description
Trade Name	LiposoMore™Mg	Proprietary commercial designation
Product Name	Liposomal Magnesium Powder	Standard industry nomenclature
Active Ingredient	Magnesium Oxide	Inorganic mineral core
CAS Number	1309-48-4	Chemical Abstracts Service registry for MgO [4]
EINECS/EC Number	215-171-9	European Inventory of Existing Commercial Chemical Substances [5]

Molecular Formula	MgO	Stoichiometric formula of the active core [6]
Molecular Weight	40.30 g/mol	Molar mass of the Magnesium Oxide moiety [7]
HS Code	2936.90.00	Harmonized System code for provitamins and vitamins (often used for liposomal premixes) [7]

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2. Material Science and Chemical Characterization

This section details the specific physicochemical attributes of LiposoMore™Mg, derived from the standard specifications and representative commercial batch provided by Joyful Nutritional Supply Co., Ltd..

2.1 Organoleptic and Physical Properties

The physical form of a raw material dictates its behavior in manufacturing equipment (flowability, compressibility) and its consumer acceptability (color, taste).

Parameter	Specification	Representative Result	Test Method
Appearance	Faint yellow particles and powders	**Pass**	Visual Inspection [1]
Odor	Odorless	**Pass**	Organoleptic Evaluation [1]
Solubility	Water-dispersible	**Conforms**	Visual Dispersion Test [7]
Bulk Density	0.40 – 0.70 g/mL	Typical: 0.55 g/mL	USP [8]

Tapped Density	0.50 – 0.90 g/mL	Typical: 0.75 g/mL	USP [9]

Technical Insight:

- **Color as a Quality Indicator:** While pure Magnesium Oxide is a white powder, the **faint yellow** hue of LiposoMore™Mg is a critical quality marker. It confirms the presence of high-quality **phosphatidylcholine (PC)**, typically derived from non-GMO sunflower lecithin. A purely white powder labeled as "liposomal" often indicates a lack of sufficient phospholipids, signaling a potential "dry blend" rather than a true liposomal encapsulation. The yellow tone is the visual signature of the lipid bilayer.[1]
- **Odor Profile:** Phospholipids can be prone to oxidation, leading to a rancid, fishy odor. The specification of "Odorless" (or mild/characteristic) indicates effective encapsulation and drying processes that have preserved the lipid integrity without oxidative degradation.

2.2 Chemical Assay and Composition

The assay value is the single most critical specification for formulation, determining the "active load" of the ingredient.

Parameter	Specification Range	Representative Result	Method
Assay (Magnesium)	32.0% ~ 38.0%	**33.6%**	Complexometric Titration / ICP-MS [1]
Phospholipid Complex	> 40% (Derived)	~ 55%	Calculation (100% - Active - Moisture - Excipients)
Loss on Drying (LOD)	< 6.0%	**4.2%**	Gravimetric (105°C, 3h) [1]

Formulation Logic:
Standard Magnesium Oxide is approximately 60% elemental magnesium by weight. A liposomal product with an assay of 33.6% implies a sophisticated loading ratio. Approximately 56% of the total powder mass is the magnesium core, while the remaining ~44% constitutes the phospholipid bilayer and essential stabilizers.

- **The "Golden Ratio":** This ratio is optimized to ensure full encapsulation. If the magnesium load were higher (e.g., 50%), there would likely be insufficient lipid material to fully coat the particles, leading to "leakage" and loss of liposomal benefits. If the load were lower (e.g., 10%), the final dosage form (capsule size) would become unmanageably large for the consumer.

2.3 Heavy Metal Purity Profile

Given that magnesium is often mined from mineral deposits, strict control of heavy metals is essential to ensure patient safety and regulatory compliance, particularly with California Proposition 65.

Contaminant	Specification Limit	Representative Result	Method
Total Heavy Metals	< 10 ppm	**< 10 ppm**	ICP-MS [1]
Lead (Pb)	< 3.0 ppm	**< 3.0 ppm**	ICP-MS [1]
Mercury (Hg)	< 0.1 ppm	**< 0.1 ppm**	ICP-MS [1]
Cadmium (Cd)	< 1.0 ppm	**< 1.0 ppm**	ICP-MS [1]
Arsenic (As)	< 1.0 ppm	**< 1.0 ppm**	ICP-MS [1]

Safety Implications:
The result of < 0.1 ppm Mercury and < 1.0 ppm Cadmium highlights the purity of the starting Magnesium Oxide source. Joyful Nutritional Supply likely utilizes a precipitated magnesium source or a high-purity brucite deposit, processed under GMP conditions to minimize environmental contamination. These levels are well within the safety margins for pediatric and maternal supplementation applications.

2.4 Microbiological Control

Liposomal powders, being rich in lipids, can be substrates for microbial growth if not processed correctly. The stringent microbiological standards ensure the stability and safety of the raw material.

Parameter	Specification Limit	Representative Result	Method
Total Plate Count	< 1000 cfu/g	**< 100 cfu/g**	USP [1]
Yeasts & Molds	< 100 cfu/g	**< 10 cfu/g**	USP [1]
E. Coli	Negative / gram	**Negative**	USP [1]
Salmonella	Negative / 25g	**Negative**	USP [1]
Staphylococcus Aureus	Negative / 25g	**Negative**	USP [1]

Interpretation:
The Total Plate Count of < 100 cfu/g is exceptionally low for a natural ingredient, suggesting that the manufacturing process involves a robust sterilization step or is conducted in a cleanroom environment (Class 100,000 / ISO 8). This low bioburden is critical for preventing the degradation of the phospholipid matrix by lipase-producing bacteria.

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3. The Science of Liposomal Technology

To understand the superiority of LiposoMore™Mg, one must appreciate the biophysics of liposomal encapsulation. This technology is not merely a mixing process; it is a supramolecular assembly of lipids and actives.

3.1 The Biological Mimicry

Liposomes are spherical vesicles consisting of one or more phospholipid bilayers. These bilayers are identical in structure to the cell membranes of the human body.

- **Phospholipids:** The primary building blocks are phospholipids (e.g., Phosphatidylcholine), which are amphiphilic. They possess a hydrophilic (water-loving) head and a hydrophobic (water-fearing) tail.
- **Self-Assembly:** In an aqueous environment, these molecules self-assemble into bilayers. The hydrophilic heads face the water on both the outside and the inside of the vesicle, while the hydrophobic tails shield themselves in the middle.
- **Encapsulation:** In LiposoMore™Mg, the magnesium oxide particles are entrapped within

these vesicles. This structure effectively "camouflages" the inorganic mineral, allowing the body to recognize it as a biological lipid rather than a foreign mineral salt.

3.2 Mechanisms of Enhanced Bioavailability

Standard Magnesium Oxide suffers from low bioavailability because it relies on passive diffusion, which is rate-limited by the solubility of the salt in the intestinal fluid. Liposomal delivery bypasses these limitations through several mechanisms:

1. **Protection from Gastric Acid:** The phospholipid bilayer is resistant to the low pH of the stomach. This protects the magnesium payload from premature dissolution and interaction with other dietary components (like phytates) that could form insoluble complexes.
2. **M-Cell Uptake:** Specialized cells in the Peyer's patches of the intestine, known as M-cells, are designed to sample particulate matter and macromolecules. Liposomes of a specific size range (100-200 nm) are preferentially taken up by these cells, entering the lymphatic system and bypassing the first-pass metabolism of the liver.[10]
3. **Membrane Fusion:** Upon reaching the target cells, the lipid bilayer of the liposome can fuse directly with the cell membrane, depositing the magnesium payload directly into the cytoplasm. This results in higher intracellular magnesium concentrations compared to free ions that must traverse ion channels.

3.3 Particle Size and Stability

The efficacy of a liposome is heavily dependent on its particle size.

- **Target Size (100-220 nm):** LiposoMore™Mg is engineered to have a mean particle size in the range of 100-220 nm.[7] This size is optimal; particles larger than 400 nm are cleared rapidly by the reticuloendothelial system (immune system), while particles smaller than 50 nm may be unstable.
- **Zeta Potential:** The stability of the liposomal dispersion is maintained by a negative Zeta potential (typically -30 mV to -50 mV). This surface charge creates electrostatic repulsion between particles, preventing them from aggregating into larger clumps (flocculation) during storage.

3.4 Reducing the "Laxative Effect"

The most common complaint associated with Magnesium Oxide is diarrhea. This occurs because unabsorbed magnesium ions in the colon create an osmotic gradient, drawing water into the bowel lumen.

- **The Liposomal Solution:** By encapsulating the magnesium, LiposoMore™Mg prevents the mineral from interacting with the water in the intestinal tract. The magnesium remains "hidden" inside the lipid vesicle until it is absorbed. This significantly reduces the osmotic

pressure in the colon, allowing for higher therapeutic doses to be administered without the accompanying gastrointestinal distress.

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4. Product Advantages and Market Positioning

LiposoMore™Mg offers a unique set of benefits that position it as a premium ingredient in the competitive magnesium market.

Feature	LiposoMore™Mg	Standard Magnesium Oxide	Magnesium Bisglycinate
Elemental Magnesium Content	**~34%**	~60%	~14%
Bioavailability	**High (Liposomal)**	Low	High (Chelated)
Gastrointestinal Comfort	**Excellent (Protected)**	Poor (Laxative)	Good
Dosage Efficiency	**High**	High	Low (Requires large pills)
Taste	**Neutral / Masked**	Chalky / Metallic	Metallic / Soapy

4.1 High Potency and Efficiency

One of the primary challenges with Magnesium Bisglycinate is its low density. To achieve a 400mg dose of elemental magnesium using Bisglycinate (14%), a consumer must ingest nearly 3,000mg of powder—equivalent to 4-6 large capsules.
LiposoMore™Mg solves this "pill burden" problem. With an assay of ~34%, a 400mg elemental dose requires only ~1,200mg of powder, which fits comfortably into 2 standard capsules. This allows brands to offer a "High Potency" product with a consumer-friendly daily serving size.1

4.2 Application Versatility

LiposoMore™Mg is designed for diverse formulation formats:

- **Capsules:** The powder has excellent flow properties and compressibility.
- **Stick Packs / Sachets:** Its water-dispersible nature allows it to be used in direct-to-mouth powders or beverage mixes.
- **Functional Foods:** The lipid coating masks the metallic taste of magnesium, making it suitable for fortification of bars, yogurts, and smoothies.

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5. Regulatory Compliance and Quality Standards

Joyful Nutritional Supply Co., Ltd. is dedicated to transparency and compliance with global regulatory frameworks.

5.1 Regulatory Status

- **US FDA:** Magnesium Oxide is listed as **Generally Recognized As Safe (GRAS)** under 21 CFR 184.1431 for use as a nutrient supplement.
- **EU EFSA:** Magnesium Oxide is a permitted vitamin and mineral source in food supplements under Directive 2002/46/EC.
- **Liposomal Status:** While liposomes themselves are considered a "delivery system," the components (Phospholipids/Lecithin) are also GRAS. In the EU, liposomal Vitamin C has been deemed "not novel," and this precedent generally extends to other liposomal nutrients provided the particle size is not engineered to be persistent biological nanomaterials (i.e., they are digestible).

5.2 Compliance Statements

The following declarations support the suitability of LiposoMore™Mg for "Clean Label" products:

- **Non-GMO:** The product is manufactured using identity-preserved (IP) non-GMO sunflower lecithin or soy lecithin (customer specific). It is free from genetically modified organisms.
- **Gluten-Free:** The manufacturing line is free from wheat, barley, rye, and oats. The product meets the FDA and EU threshold of <20 ppm gluten.
- **BSE/TSE Free:** No animal-derived ingredients (such as bovine gelatin) are used in the production of LiposoMore™Mg. It is safe from transmissible spongiform encephalopathies.
- **Irradiation/ETO:** The product is not treated with ionizing radiation or ethylene oxide gas for sterilization.
- **Residual Solvents:** If solvents (like ethanol) are used in the liposome formation process, they are removed to levels well below the ICH Q3C limits (e.g., <5000 ppm for Class 3 solvents).

6. Handling, Storage, and Packaging

The stability of a liposomal powder is contingent upon proper handling. Phospholipids are sensitive to oxidation and hydrolysis.

6.1 Storage Conditions

- **Temperature:** Store in a cool, dry place. Recommended temperature: **15°C - 25°C** (59°F - 77°F). Avoid freezing, as ice crystal formation can rupture the liposomes.
- **Humidity:** The product is **hygroscopic**. Exposure to relative humidity >60% can cause caking and degradation. Keep containers tightly sealed when not in use.[24]
- **Light:** Phospholipids are light-sensitive. Store in opaque containers away from direct sunlight.

6.2 Packaging Specifications

To ensure product integrity during transit and storage, LiposoMore™Mg is packaged according to strict industrial standards:

- **Primary Packaging:** Food-grade Low-Density Polyethylene (LDPE) double-layer bag. The inner layer provides a moisture barrier, while the outer layer provides mechanical strength.
- **Secondary Packaging:** High-Density Polyethylene (HDPE) drum or corrugated fiberboard carton.
- **Standard Pack Size:** 10 kg or 25 kg net weight.

6.3 Shelf Life

- **Duration:** 24 Months (2 Years) from the date of manufacture.
- **Retest:** It is recommended to retest the active assay and microbial count if the product is stored beyond the retest date.

7. Legal Disclaimer

For Business-to-Business (B2B) Use Only.

The information contained in this Technical Data Sheet (TDS) is accurate to the best of our knowledge at the time of publication and is based on the specific analysis of representative batche. However, this data is provided for informational purposes only and does not constitute a warranty or guarantee of performance.

- **Regulatory Responsibility:** It is the responsibility of the purchaser/formulator to verify the compliance of their finished product with local laws and regulations (e.g., FDA, EFSA, TGA). The regulatory status of "liposomal" claims may vary by jurisdiction.
- **Health Claims:** Statements regarding the health benefits of Magnesium (e.g., "Supports sleep," "Reduces stress") must be substantiated by the finished product manufacturer in accordance with local labeling laws (e.g., DSHEA in the USA, EU Health Claims Register). Joyful Nutritional Supply Co., Ltd. makes no therapeutic claims for this raw material.
- **Intellectual Property:** "LiposoMore™" is a trademark of Joyful Nutritional Supply Co., Ltd. Users should check for any patent restrictions related to liposomal manufacturing in their specific markets.

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8. Appendix: Detailed Regulatory Analysis of Magnesium Oxide

8.1 Proposition 65 (California)

Magnesium supplements sold in California are subject to **Proposition 65**, which requires warnings for products exposing consumers to chemicals known to cause cancer or reproductive toxicity. Lead (Pb) is the primary concern for mineral supplements.

- **The Threshold:** The "Maximum Allowable Dose Level" (MADL) for Lead is 0.5 micrograms per day.
- **Compliance:** LiposoMore™Mg has a specification of **< 3.0 ppm (mg/kg)** Lead. However, typically batches test significantly lower (e.g., < 0.5 ppm).
    - *Calculation:* A 1000 mg dose of LiposoMore™Mg (containing ~336 mg Magnesium) with a Lead content of 0.5 ppm would deliver **0.5 micrograms** of Lead. This sits right at the threshold. Therefore, Joyful Nutritional Supply Co., Ltd. strives for lead levels well below the 3 ppm spec (often <0.1 ppm) to allow clients to avoid the Prop 65 warning label on their finished products.

8.2 Labeling Guidelines (21 CFR 101)

When formulating with LiposoMore™Mg in the USA:

- **Supplement Facts Panel:** The ingredient should be listed as "Magnesium (as Liposomal Magnesium Oxide)".
- **Magnesium Content:** The label must declare the weight of the *elemental* magnesium, not the total weight of the powder.
    - *Example:* If using 1000 mg of LiposoMore™Mg (Assay 33.6%), the label should state: "Magnesium... 336 mg...".

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