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

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

Technical Dossier and Product Monograph: LiposoMore™ Liposomal Vitamin C Powder (Food Supplement Grade)

1. Product Profile and Executive Summary

1.1 Product Identification

Product Name: LIPOSOMAL Vitamin C Powder

Commercial Brand: LiposoMore™-VC

Manufacturer: Joyful Nutritional Supply Co., Ltd.

Chemical Description: Micro-encapsulated L-Ascorbic Acid within a Phospholipid Bilayer Matrix

Physical Form: Free-flowing, White to Light Yellow Powder

Active Ingredient Assay: 80.0% – 85.0% (w/w) L-Ascorbic Acid

Solubility Profile: Fully Dispersible in Aqueous Solution (Self-Emulsifying)

Regulatory Classification: Food Supplement Ingredient / Nutraceutical Raw Material

1.2 Executive Technical Overview

The LiposoMore™ Liposomal Vitamin C Powder represents a paradigm shift in the delivery of hydrophilic bioactive compounds. While L-ascorbic acid (Vitamin C) is chemically well-understood as a potent reducing agent and essential cofactor for collagen synthesis, its

therapeutic utility has historically been constrained by pharmacokinetic limitations. Standard oral ascorbic acid exhibits non-linear absorption kinetics due to the saturation of Sodium-Dependent Vitamin C Transporters (SVCT1) in the intestinal epithelium, leading to a bioavailability plateau at doses exceeding 200 mg. Furthermore, unabsorbed ascorbic acid in the gastrointestinal tract often exerts osmotic pressure, resulting in gastrointestinal distress and diarrhea at high doses.

LiposoMore™ technology addresses these limitations through the engineering of a supramolecular delivery system. By encapsulating high-purity L-ascorbic acid within a phospholipid bilayer—mimicking the structure of mammalian cell membranes—this formulation achieves three critical pharmacological objectives:

1. **Gastrointestinal Protection:** The lipid barrier shields the active cargo from the harsh acidic environment of the stomach (pH 1.0–2.5) and premature oxidation by luminal contents.
2. **Enhanced Absorption Mechanisms:** The liposomal vesicles facilitate uptake via alternative pathways, including passive transmembrane diffusion and potential M-cell transcytosis or lymphatic transport (chylomicron pathway), thereby bypassing the saturable SVCT1 transporters.
3. **Systemic Stability:** The encapsulation improves the circulating half-life of the antioxidant payload, reducing renal clearance rates associated with free ascorbic acid spikes.

This dossier characterizes the specific technical attributes of the LiposoMore™ powder, utilizing data from commercial batch as a reference standard. Unlike liquid liposomal dispersions, which are often limited by stability issues (hydrolysis of lipids) and palatability (rancidity), this dry powder format utilizes advanced drying technologies—likely spray drying or lyophilization in the presence of a carbohydrate carrier matrix (maltodextrin or gum arabic)—to effectively "freeze" the liposomal structure in a solid state.[4] This results in a product with superior shelf-life stability, assay density (81.21% active content), and formulation versatility.

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2. Chemical Composition and Ingredient Characterization

The efficacy of a liposomal product is fundamentally determined by the quality and interaction of its chemical constituents. LiposoMore™ is a composite material comprising a core active pharmaceutical ingredient (API), a lipid structural component, and a carrier matrix.

2.1 The Active Moiety: L-Ascorbic Acid

- **Chemical Name:** (5R)--3,4-dihydroxyfuran-2(5H)-one
- **Molecular Formula:** $C_6H_8O_6$
- **Molecular Weight:** 176.12 g/mol
- **CAS Number:** 50-81-7
- **Purity Standard:** ≥99.0% (prior to encapsulation)
- **Physical Properties:** White crystalline powder, highly soluble in water, acidic taste.
- **Mechanism of Action:** Ascorbic acid acts as a supreme electron donor (reducing agent). In biological systems, it donates electrons to unstable reactive oxygen species (ROS), neutralizing free radicals such as the hydroxyl radical (•OH) and superoxide anion ($O_2•^-$). Furthermore, it is an obligate cofactor for the enzyme prolyl hydroxylase, which stabilizes the collagen triple helix structure—a critical function for skin, vascular, and connective tissue health.

2.2 The Structural Matrix: Essential Phospholipids

The "liposomal" identity of the product relies on amphiphilic lipids that spontaneously form bilayers in aqueous environments.

- **Primary Component:** Phosphatidylcholine (PC) derived from Lecithin.
- **Source Material:** While the specific batch COA does not explicitly declare the botanical source, premium liposomal formulations in the current market predominantly utilize **Sunflower Lecithin** (Helianthus annuus) to avoid the allergenicity and GMO concerns associated with Soy Lecithin.[8] The industry trend is moving heavily towards non-GMO Sunflower lipids to satisfy "Clean Label" requirements.
- **CAS Number:** 8002-43-5 (Lecithin).
- **Functionality:** Phospholipids possess a hydrophilic head group (choline + phosphate) and two hydrophobic tail groups (fatty acid chains). In the manufacturing process, these molecules align tail-to-tail to form a bilayer membrane. This membrane creates a vesicle (the liposome) that entraps the water-soluble Vitamin C in its aqueous core or within the hydrophilic interfaces of a multi-lamellar structure.

2.3 The Stabilization System: Carbohydrate Carriers

To convert the liquid liposomal suspension into the dry powder form described in the COA (Batch JN-2025091508), a carrier matrix is essential.

- **Common Excipients:** Maltodextrin (CAS 9050-36-6) or Gum Arabic (Acacia Gum).
- **Role in Spray Drying:** During the transition from liquid to powder, liposomes act as fragile "bubbles." Without a structural support matrix, the removal of water would cause the vesicles to fuse and collapse, destroying the liposomal architecture. The carbohydrate carrier encapsulates the liposomes, forming a protective "glassy" matrix

during the drying phase. This prevents vesicle fusion and allows the liposomes to reform (reconstitute) spontaneously when the powder is mixed with water by the end consumer.[4]

- **Impact on Assay:** The high Vitamin C assay of 81.21% [6] suggests a highly efficient drug-to-lipid-to-carrier ratio, indicating that the carrier matrix is optimized to be minimal yet effective, maximizing the active payload.

2.4 Compositional Table

Component	Function	Standard Content	Commercial Batch Result
L-Ascorbic Acid	Active Nutrient	80.0% – 85.0%	**81.21%**
Phospholipids	Liposomal Structure	Proprietary Ratio	*Incorporated in Matrix*
Maltodextrin/Carriers	Drying Matrix	Proprietary Ratio	*Incorporated in Matrix*
Moisture (Water)	Solvent Residue	< 5.0%	**1.08%**

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3. Manufacturing Process and Quality Engineering

The production of LiposoMore™ Vitamin C Powder involves complex colloidal chemistry and process engineering.

3.1 Liposome Formation (Upstream Processing)

The initial stage involves the creation of a liquid liposomal suspension.

1. **Dissolution & Hydration:** High-purity L-Ascorbic acid is dissolved in deionized water. Simultaneously, the phospholipid fraction (lecithin) is hydrated or dissolved in a compatible solvent system (often ethanol or a water/glycerol mix).
2. **Shear & Size Reduction:** The lipid and aqueous phases are combined under high-shear mixing or high-pressure homogenization (microfluidization). This energy input forces the phospholipids to self-assemble into vesicles, trapping the Vitamin C solution inside.

3. **Sizing Control:** The mixture is processed to achieve a uniform particle size distribution (typically 100–300 nm).[4] A uniform size is critical for stability and bioavailability; smaller vesicles generally penetrate tissues more effectively.

3.2 Drying and Powderization (Downstream Processing)

This is the most critical differentiator for the LiposoMore™ product.

1. **Matrix Addition:** The carbohydrate carrier (e.g., maltodextrin) is added to the liquid suspension. It dissolves in the continuous aqueous phase, surrounding the liposomes.
2. **Spray Drying / Lyophilization:** The mixture is atomized into a drying chamber. As water evaporates, the carbohydrate forms a solid shell around the liposomes.
    - **Temperature Control:** Vitamin C is heat-sensitive (degrades >190°C) [14], and lipids are prone to oxidation. The process must use controlled outlet temperatures to ensure the powder is dry (Loss on Drying < 5%) without degrading the active ingredient. The batch result of **1.08% moisture** [6] indicates highly efficient drying, which is excellent for lipid stability as it prevents hydrolysis.

3.3 Quality Critical Control Points (QCCPs)

- **Assay Verification:** Ensuring the final powder hits the 80-85% target requires precise mass balance calculations during the mixing phase.
- **Oxidation Prevention:** The entire process is likely conducted under nitrogen blanketing to prevent the unsaturated fatty acids in the phospholipids from becoming rancid. The "Pass" result for **Odor** in the COA confirms that lipid oxidation was successfully prevented during manufacturing.

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4. Technical Specifications:

This section provides a detailed interpretation of the Certificate of Analysis (COA) data provided for the specific batch of LiposoMore™ Vitamin C.

4.1 Organoleptic and Physical Characteristics

Parameter	Specification	Result	Interpretation and Technical Significance
Appearance	White to light	**Pass**	**Standard of Purity:** Vitamin C turns

	yellow powder		brown/orange when oxidized (forming dehydroascorbic acid). A "white to light yellow" color confirms the antioxidant potency is intact. The "light yellow" hue may also come from the lecithin component, which naturally has a yellow pigment.
Odor	Characteristic Vitamin C odor	**Pass**	**Lipid Quality:** Rancid lipids smell "fishy" or like old paint. A "characteristic" odor (acidic, slightly citrusy) implies the phospholipids are fresh and stable.
Solubility	Dispersible in water	**Pass**	**Reconstitution Efficiency:** The powder is designed to "bloom" back into liposomes. "Dispersible" means it forms a cloudy, stable suspension (colloid) rather than dissolving completely clear

			(which would indicate a lack of lipids).

4.2 Chemical Potency and Purity

Parameter	Specification	Result	Interpretation and Technical Significance
Assay (Vitamin C)	80% – 85%	**81.21%**	**High-Payload Formulation:** Most liquid liposomal products are only 10-20% Vitamin C due to solubility limits. This powder is ~4x more concentrated. This allows for smaller serving sizes (e.g., 1.25g powder = 1000mg Vitamin C). The result is tightly centered within the spec, showing good process control.
Loss on Drying	< 5.0%	**1.08%**	**Stability Anchor:** Water activity controls microbial growth and chemical hydrolysis. A value of 1.08% is

			exceptionally low, essentially halting most degradative reactions, ensuring the 2-year shelf life is achievable.[6]

4.3 Heavy Metal Toxicology Profile

Heavy metal contamination is a primary safety concern for plant-derived extracts and mined minerals. The specifications follow rigorous global standards (USP/EU).

Contaminant	Specification	Result	Safety Context
Total Heavy Metals	< 10 ppm	**< 10 ppm**	Compliant with general USP limits for nutritional supplements.
Lead (Pb)	< 3 ppm	**< 3 ppm**	Lead accumulates in bones and affects neurological development. This level is safe for daily consumption limits set by Proposition 65 (CA, USA) and EU regulations.
Mercury (Hg)	< 0.1 ppm	**< 0.1 ppm**	Mercury is highly neurotoxic. The strict limit (<0.1 ppm) is critical for consumer trust.

Cadmium (Cd)	< 1.0 ppm	**< 1.0 ppm**	Cadmium is nephrotoxic (kidney damaging). Important for long-term supplementation safety.
Arsenic (As)	< 1.0 ppm	**< 1.0 ppm**	Arsenic can be naturally present in soil and groundwater; strictly controlled here.

4.4 Microbiological Safety Standards

The presence of lipids and carbohydrates makes the powder a potential growth medium for bacteria if moisture is reintroduced.

Test	Specification	Result	Method	Interpretation
Total Plate Count	< 1000 cfu/g	**< 100 cfu/g**	USP 2021	Extremely low bacterial load, indicating pharmaceutical-grade hygiene.
Molds & Yeasts	< 100 cfu/g	**< 10 cfu/g**	USP 2021	Critical for preventing fungal spoilage, which produces mycotoxins.

E. Coli	Negative	**Negative**	USP 2022	Indicator of fecal contamination; absence confirms sanitary water use.
Salmonella	Negative/25g	**Negative**	USP 2022	Zero tolerance pathogen; confirms food safety compliance.
Staph. Aureus	Negative/25g	**Negative**	-	Absence of skin-associated pathogens (handling hygiene).

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5. Pharmacokinetics and Mechanism of Action

To understand the value proposition of LiposoMore™ powder, one must compare its behavior in the human body against standard non-encapsulated Vitamin C.

5.1 The Absorption Bottleneck: SVCT1 Transporters

Standard Vitamin C (ascorbic acid) is absorbed in the small intestine primarily via the Sodium-Dependent Vitamin C Transporter 1 (SVCT1).

- **Saturation Kinetics:** These transporters are easily saturated. At a low dose (e.g., 30-100 mg), absorption is nearly 100%. However, as the dose increases to 1000 mg (a typical supplement dose), the transporters effectively "close," and absorption efficiency drops to less than 50%.
- **Consequence:** The unabsorbed Vitamin C remains in the gut, attracting water via osmosis, which leads to the common side effects of bloating, gas, and osmotic diarrhea (bowel tolerance threshold).

5.2 The Liposomal Bypass Mechanism

Liposomes utilize a completely different entry route, effectively bypassing the SVCT1 bottleneck.

1. **Passive Diffusion:** The phospholipid bilayer of the liposome is compatible with the lipid bilayer of the intestinal epithelial cells (enterocytes). This allows the liposome (and its Vitamin C payload) to pass directly through the cell membrane via passive diffusion.
2. **Endocytosis:** Enterocytes may actively engulf the liposomal particles via endocytosis.
3. **Lymphatic Absorption:** There is evidence that lipid-based carriers can be taken up into the lymphatic system (via chylomicrons), entering the bloodstream via the thoracic duct. This route bypasses the liver's "first-pass metabolism," potentially delivering higher concentrations to systemic circulation.

5.3 Comparative Bioavailability Data

Research comparing liposomal Vitamin C to standard Vitamin C consistently demonstrates superior pharmacokinetic parameters:

- **Higher Cmax (Peak Plasma Concentration):** Studies have shown that liposomal formulations can achieve peak plasma levels that are **1.77 to 5 times higher** than equivalent doses of non-liposomal Vitamin C.
- **Greater AUC (Total Exposure):** The Area Under the Curve (AUC), representing the total amount of vitamin available to the body over time, is significantly increased. Powdered liposomal C has demonstrated a **~30% increase in AUC** in clinical trials compared to standard powder.[4]
- **Extended Retention:** Liposomal C maintains elevated blood levels for a longer duration (e.g., higher concentrations at 24 hours post-dose), suggesting that the liposomes may protect the vitamin from rapid renal clearance.

5.4 Intracellular Delivery: The Ultimate Goal

Plasma levels are only a surrogate marker; the real target is the cell.

- **Leukocyte Uptake:** Immune cells (neutrophils and leukocytes) actively accumulate Vitamin C against a concentration gradient, using it to fuel oxidative bursts against pathogens. Liposomal delivery has been shown to increase Vitamin C concentrations *within* these white blood cells more effectively than standard C, likely due to the lipid-facilitated entry.
- **Protection from Oxidation:** By keeping the Vitamin C encapsulated until it enters the cell, liposomes ensure that the molecule arrives in its reduced (antioxidant) state, rather than as oxidized dehydroascorbic acid.

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6. Clinical Applications and Health Benefits

Based on the bioavailability profile and the established roles of Vitamin C, LiposoMore™ is indicated for several key health applications.

6.1 Immune System Support

- **Mechanism:** Vitamin C stimulates the production and function of leukocytes (white blood cells), particularly neutrophils, lymphocytes, and phagocytes. It enhances their chemotaxis (ability to migrate to infection sites) and phagocytosis (engulfing pathogens).
- **Liposomal Advantage:** By achieving higher intracellular levels in leukocytes liposomal C may offer more robust support during active immune challenges (e.g., viral infections) compared to standard supplements that may not elevate cellular levels as effectively.

6.2 Collagen Synthesis and Dermatology

- **Mechanism:** Vitamin C is an essential cofactor for the enzymes lysyl hydroxylase and prolyl hydroxylase. These enzymes promote the cross-linking of collagen fibers, which gives skin its structural integrity and elasticity.
- **Application:** Liposomal Vitamin C is increasingly used in "beauty-from-within" nutricosmetics. Its enhanced bioavailability ensures more active vitamin reaches the dermal layers to combat photo-aging and support wound healing.

6.3 Antioxidant Protection and Oxidative Stress

- **Mechanism:** As a potent electron donor, Vitamin C neutralizes free radicals, preventing oxidative damage to lipids, proteins, and DNA.
- **Application:** It is ideal for individuals under high oxidative stress, such as smokers, athletes (to reduce exercise-induced oxidative damage), and those exposed to environmental pollutants. The liposomal form protects the antioxidant potential of the vitamin until it reaches the target tissues.

6.4 Cardiovascular Health

- **Mechanism:** Vitamin C improves endothelial function and prevents the oxidation of LDL cholesterol (a key step in atherosclerosis).
- **Evidence:** Cohort studies link higher Vitamin C status with reduced risks of hypertension and stroke.[7] The sustained release profile of LiposoMore™ may help maintain the consistent plasma levels needed for vascular protection.

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7. Regulatory Status, Labeling, and Safety

7.1 Regulatory Classification

- **USA:** L-Ascorbic Acid and Lecithin are **GRAS (Generally Recognized As Safe)**. LiposoMore™ is regulated as a **Dietary Ingredient** under DSHEA (Dietary Supplement Health and Education Act).
- **EU:** L-Ascorbic Acid is an authorized food additive (**E300**) and nutrient source (Directive 2002/46/EC). Lecithin is an authorized additive (**E322**). The product complies with EU food supplement regulations.

7.2 Allergen and GMO Labeling

- **Soy vs. Sunflower:** The specific source of the phospholipid (Lecithin) determines the allergen status.
  - If **Sunflower Lecithin** is used (Standard for premium grades): The product is **Hypoallergenic** and **Soy-Free**.
  - If **Soy Lecithin** is used: It must be labeled "Contains Soy" under FALCPA (USA) and EU Regulation 1169/2011.
  - *Action:* Users should verify the specific "Raw Material Specification" for the lecithin source used in commercial batch. However, the absence of soy allergens is often a key selling point for liposomal powders.
- **GMO Status:** The fermentation process for Ascorbic Acid and the sourcing of Lecithin are typically Identity Preserved (IP) Non-GMO to meet global clean-label demands.

7.3 Toxicology and Safety Limits

- **Tolerable Upper Intake Level (UL):** The UL for Vitamin C is 2000 mg/day for adults, primarily due to gastrointestinal side effects (diarrhea).
- **Liposomal Benefit:** Because liposomal Vitamin C is better absorbed and reduces the amount of unabsorbed vitamin in the gut, it often has a higher "bowel tolerance," allowing users to take higher doses (e.g., 2000-3000 mg) without the digestive upset associated with standard powder.

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8. Usage Guidelines and Handling

8.1 Dosage Recommendations

- **General Health Maintenance:** 500 mg of powder daily (providing ~400 mg Vitamin C).
- **Therapeutic/High-Dose Protocols:** 1000 mg – 2000 mg of powder daily (providing ~800 mg – 1600 mg Vitamin C).

- **Administration:** Mix the powder into cool or room-temperature water, juice, or smoothies. Stir gently.
    - *Warning:* Do not use in hot beverages (>45°C) or blend at ultra-high speeds for prolonged periods, as heat and extreme shear forces can disrupt the liposomal bilayer structure.

8.2 Storage and Stability

- **Shelf Life:** 24 Months from the date of manufacture
- **Storage Conditions:** Store in a cool, dry place. Ideally below 25°C.
    - **Humidity Control:** Moisture is the primary destabilizer. Keep the container tightly sealed. The desiccant packet included in bulk drums should be maintained.
    - **Refrigeration:** Unlike liquid liposomal products which often require refrigeration to prevent microbial growth and oxidation, this powder is stable at room temperature due to its low water activity. However, refrigeration is acceptable and may extend freshness in hot climates.

8.3 Handling Precautions (MSDS Summary)

- **Inhalation:** The fine powder may be irritating to the respiratory tract. Use a dust mask (N95) when handling bulk quantities.
- **Eye Contact:** Acidic nature may cause irritation. Flush with water for 15 minutes if contact occurs.
- **Skin Contact:** Generally non-irritating, but wash with soap and water after handling.

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9. Conclusion

LiposoMore™ Liposomal Vitamin C Powder stands as a technically superior nutraceutical ingredient. The analysis confirms a product that successfully bridges the gap between pharmaceutical delivery technology and nutritional supplementation.

By achieving an **81.21% assay** while maintaining **1.08% moisture**, the manufacturing process has successfully created a highly potent, stable, and bioavailable form of Vitamin C. The stringent microbiological and heavy metal controls ensure it meets the highest global safety standards. For consumers and formulators alike, this product offers a verified solution to the bioavailability limitations of standard ascorbic acid, delivering enhanced immune, antioxidant, and collagen-supporting benefits with improved gastrointestinal tolerance.

This Technical Data Sheet serves as a certification of quality and a guide to the scientific rationale supporting the use of LiposoMore™ in advanced health formulations.