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

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

PRODUCT DOSSIER & TECHNICAL MASTER FILE

LiposoMore™ Liposomal Coenzyme Q10

Document Type: Technical Master File (TMF) & Technical Data Sheet (TDS)
Product Name: Liposomal Coenzyme Q10 Powder (LiposoMore™)
Manufacturer: Joyful Nutritional Supply Co., Ltd.
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1. Executive Summary

This Comprehensive Technical Master File serves as the definitive authoritative document for **LiposoMore™ Liposomal Coenzyme Q10**, a premium, high-bioavailability nutraceutical ingredient engineered by **Joyful Nutritional Supply Co., Ltd.**

The global dietary supplement market has evolved beyond simple nutrient delivery to a focus on **bio-efficiency**. Coenzyme Q10 (CoQ10), while essential for mitochondrial energy production and cardiovascular health, suffers from notoriously poor oral bioavailability due to its high molecular weight and extreme lipophilicity. Traditional crystalline CoQ10 exhibits absorption rates as low as 1-5% in the human gastrointestinal tract.

LiposoMore™ addresses this critical pharmacological limitation through advanced **liposomal microencapsulation**. By engineering a "pro-liposomal" dry powder matrix composed of

non-GMO soy protein isolates and phospholipids, we have created a delivery system that:

1. **Protects** the active Ubiquinone from gastric degradation.
2. **Enhances** water dispersibility, allowing for seamless integration into diverse formulations.
3. **Optimizes** cellular uptake via phospholipid bilayer fusion mechanisms.

This dossier provides a complete technical characterization of the product, adhering to the strictest global quality standards (USP/EP). It includes the official Technical Data Sheet (TDS), detailed specification commentaries, scientific substantiation of the liposomal mechanism, manufacturing quality assurance (QA) protocols, and regulatory compliance statements.

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2. Official Technical Data Sheet (TDS)

Product Identity

- **Product Name:** Liposomal Coenzyme Q10 Powder
- **Brand:** LiposoMore™
- **Product Code:** JN-LIPO-Q10
- **Active Ingredient:** Ubidecarenone (Coenzyme Q10)
- **Chemical Name:** 2-[(2E,6E,10E,14E,18E,22E,26E,30E,34E)-3,7,11,15,19,23,27,31,35,39-decamethyltetraconta-2,6,10,14,18,22,26,30,34,38-decaenyl]-5,6-dimethoxy-3-methylcyclohexa-2,5-diene-1,4-dione
- **CAS Number:** 303-98-0 (CoQ10)
- **Carrier System:** Non-GMO Soy Protein Isolate, Phospholipids (from Soy Lecithin)

Manufacturer Information

- **Company:** Joyful Nutritional Supply Co., Ltd.
- **Address:** No. 2045 Songbai Road, Baoan District, Shenzhen 518105, China
- **Contact:** sales@joyfulnutritional.com

2.1 Physical & Chemical Specifications

Parameter	Specification	Method
Appearance	Orange granules and free-flowing powder	Visual
Odor	Odorless to characteristic soy/lipid notes	Organoleptic

Solubility	Dispersible in water (forms liposomal suspension)	Visual/Dissolution
Assay (Coenzyme Q10)	48.0% – 52.0%	HPLC
Loss on Drying	≤ 5.0%	USP
Particle Size	≥ 95% pass 80 mesh	USP
Bulk Density	0.40 – 0.60 g/mL	USP
pH (1% Solution)	5.5 – 7.5	Potentiometric

2.2 Contaminant Limits (Heavy Metals)

Parameter	Limit	Method
Total Heavy Metals	≤ 10 ppm	ICP-MS
Lead (Pb)	≤ 3.0 ppm	ICP-MS
Arsenic (As)	≤ 1.0 ppm	ICP-MS
Cadmium (Cd)	≤ 1.0 ppm	ICP-MS
Mercury (Hg)	≤ 0.1 ppm	ICP-MS

2.3 Microbiological Standards

Parameter	Limit	Method
Total Plate Count	≤ 1,000 CFU/g	USP
Yeast & Mold	≤ 100 CFU/g	USP
Escherichia coli	Negative in 10g	USP

Salmonella	Negative in 25g	USP
Staphylococcus aureus	Negative in 25g	USP

2.4 Ingredients Composition

- **Coenzyme Q10 (Ubiquinone):** 50% (approx.)
- **Liposomal Matrix (Soy Lecithin Phospholipids, Soy Protein Isolate, Food Starch/Gum Arabic):** 50% (approx.)

2.5 Storage & Stability

- **Shelf Life:** 24 months from the date of manufacture in original unopened packaging.
- **Storage Conditions:** Store in a cool, dry place (15°C–25°C). Protect from light, moisture, and oxygen. The product is hygroscopic; keep container tightly sealed.
- **Packaging:** 1kg/Aluminum Foil Bag; 25kg/Fiber Drum with double PE liners.

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3. Product Advantages & Scientific Substantiation

The superiority of **LiposoMore**™ lies in its sophisticated delivery system. While generic CoQ10 struggles to cross the aqueous layer of the intestinal mucosa, our liposomal formulation utilizes a biomimetic approach to enhance absorption.

3.1 Advanced Liposomal Encapsulation Technology

Standard CoQ10 is a crystalline powder with a melting point of ~48°C. In the human gut (37°C), it remains in a solid, crystalline state, which severely limits its dissolution and subsequent absorption.

LiposoMore™ employs a "Pro-Liposomal" powder technology.

- **The Mechanism:** We dissolve CoQ10 into a lipid phase containing high-quality phospholipids derived from non-GMO soy lecithin. Through high-pressure homogenization, we create nano-sized oil droplets. These droplets are then spray-dried within a protective **Soy Protein Isolate** matrix.
- **Reconstitution:** Upon contact with water (in a beverage or gastric fluids), the powder spontaneously reorganizes. The amphiphilic phospholipids orient their hydrophilic heads outward and hydrophobic tails inward, forming **liposomes**—spherical vesicles that entrap the CoQ10 within their lipid bilayer.[1]
- **Protection:** This bilayer shields the CoQ10 from the harsh acidic environment of the stomach (pH 1.5–3.5), preventing degradation before it reaches the absorption sites in

the small intestine.[1]

3.2 Enhanced Bioavailability and Absorption

Scientific literature supports the efficacy of liposomal carriers for hydrophobic nutrients:

- **Bypassing the Micelle Rate-Limiting Step:** Normal fat digestion requires bile salts to emulsify fats into micelles. Liposomes mimic these micelles, allowing for faster and more efficient transport across the unstirred water layer (UWL) of the intestinal epithelium.[1]
- **Cellular Fusion:** Phospholipids (Phosphatidylcholine) are major components of human cell membranes. Liposomes can fuse directly with enterocyte membranes or be absorbed via endocytosis, delivering the CoQ10 payload directly into the cell.[1]
- **Clinical Evidence:** Comparative pharmacokinetic studies of liposomal CoQ10 versus standard crystalline CoQ10 typically demonstrate a **3-5 fold increase** in C_{max} (peak plasma concentration) and AUC (total absorption over time).[1]

3.3 The Soy Protein Advantage

Unlike synthetic surfactants (e.g., Polysorbates), LiposoMore™ utilizes **Soy Protein** as a structural matrix.

- **Stability:** Research indicates that soy protein hydrolysates and isolates interact with the phospholipid membrane to increase the physical stability of the liposome, preventing leakage of the active ingredient during storage.[6]
- **Clean Label:** This allows for a "clean label" declaration, appealing to consumers looking for plant-based, natural ingredients.[8]

3.4 Water Dispersibility

A key feature of LiposoMore™ is its ability to disperse in water. Standard CoQ10 floats and clumps. LiposoMore™ forms a stable, cloudy suspension (emulsion) in cold water. This versatility enables its use in:

- Ready-to-drink (RTD) beverages.
- Powdered drink mixes (stick packs).
- Gummies and functional foods.

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4. Comprehensive Specification Commentary

This section provides a detailed analysis of the specifications listed in the COA [10] and TDS, explaining the rationale and methodology behind each parameter.

4.1 Assay (48.0 - 52.0%)

The product is standardized to contain roughly 50% active Coenzyme Q10.

- **Rationale:** A 100% CoQ10 powder would be purely crystalline and poorly absorbed. The 50% "active load" represents the optimal ratio of Active Ingredient to Carrier Matrix (Phospholipids + Protein). This ratio is critical to ensure that there is enough lipid material to fully encapsulate the CoQ10 molecules upon rehydration. If the load were higher (e.g., 90%), there would be insufficient phospholipid to form stable liposomes, negating the bioavailability benefit.
- **Methodology:** High-Performance Liquid Chromatography (HPLC) is used to separate and quantify the Ubiquinone, ensuring precise dosing.

4.2 Appearance (Orange Granules/Powder)

- **Chemistry of Color:** Coenzyme Q10 is a benzoquinone. Its conjugated double bond system absorbs blue light, reflecting a characteristic bright orange/yellow color.
- **Quality Indicator:** A change in color (e.g., to dark brown or white) would indicate degradation or oxidation. The "Orange" specification confirms the integrity of the quinone ring structure. The granular form improves flowability and reduces dust during manufacturing.[9]

4.3 Loss on Drying (< 5.0%)

- **Stability Criticality:** Liposomal powders are hygroscopic due to the phospholipid content. Excess moisture can lead to hydrolysis of the phospholipids (breaking them down into fatty acids) and microbial growth.
- **Performance:** The COA result of **1.0%** [10] is exceptional. It indicates a highly efficient drying process, ensuring a long shelf life and preventing the powder from caking.

4.4 Heavy Metals Profile (Compliance with USP/EU)

Joyful Nutritional Supply Co., Ltd. employs rigorous raw material screening.

- **Lead (Pb) < 3 ppm:** Lead is a ubiquitous environmental contaminant. Our limit is strictly aligned with the USP limits for dietary supplements.
- **Mercury (Hg) < 0.1 ppm:** Given that some CoQ10 synthesis methods or raw materials can introduce trace contaminants, our limit of 0.1 ppm is one of the strictest in the industry, ensuring safety for long-term daily supplementation.
- **Arsenic & Cadmium:** Controlled to ensure no toxicity to the renal or hepatic systems.

4.5 Microbiological Purity

The COA confirms:

- **Total Plate Count < 1000 CFU/g:** Indicates excellent sanitary conditions during manufacturing (GMP).
- **Pathogens (E. coli, Salmonella, S. aureus): Negative.** This is non-negotiable for

food-grade ingredients. The soy protein source is pasteurized prior to spray drying to eliminate any biological risk.[10]

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5. Regulatory Compliance Statements

LiposoMore™ is designed for global compliance. The following statements can be used for dossier submissions and label claims.

5.1 Non-GMO Statement

Status: Non-GMO
Declaration: The Coenzyme Q10 active ingredient is produced via fermentation (yeast/bacterial) and is free from genetically modified DNA. The Soy Protein and Soy Lecithin carriers are sourced from Identity Preserved (IP) non-GMO soybean crops. PCR testing is performed to validate the absence of GMO markers.11

5.2 Allergen Statement

Status: Contains Soy
Declaration: This product contains ingredients derived from Soy (Soy Protein Isolate, Soy Lecithin).

- **Risk Assessment:** While the manufacturing process removes the vast majority of allergenic fractions, soy is a major allergen listed in FALCPA (USA) and EU Regulation 1169/2011. Finished products *must* declare "Contains Soy" on the label.
- **Cross-Contamination:** The facility has dedicated lines or rigorous CIP (Clean-in-Place) procedures to prevent cross-contamination with other allergens like dairy or gluten.[12]

5.3 Gluten-Free Statement

Status: Gluten-Free
Declaration: The product contains no wheat, rye, barley, or oats. Batch testing confirms gluten levels are < 20 ppm, meeting the FDA and EU definition of "Gluten-Free".13

5.4 BSE/TSE Free Statement

Status: BSE/TSE Free
Declaration: All ingredients are of plant (Soy) or microbial (CoQ10 fermentation) origin. No animal-derived ingredients (bovine, ovine, caprine) are used in the manufacturing process. There is no risk of Bovine Spongiform Encephalopathy (BSE).11

5.5 Irradiation & ETO Statement

Status: Non-Irradiated / ETO-Free
Declaration: The product is not sterilized using ionizing radiation or Ethylene Oxide (ETO). Microbial control is achieved via thermal processing and strict hygiene protocols.

5.6 Residual Solvents

Status: Compliant
Declaration: The manufacturing process adheres to ICH Q3C guidelines. Any solvents used (e.g., ethanol for extraction) are removed to levels below the Class 3 threshold (5000 ppm), ensuring product safety.14

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6. Manufacturing & Quality Assurance

Joyful Nutritional Supply Co., Ltd. operates under a quality system certified to **ISO 9001:2015** and **cGMP** (Current Good Manufacturing Practice) standards for dietary supplements.

6.1 Manufacturing Flow Chart (Summary)

1. **Preparation of Lipid Phase:** Coenzyme Q10 crystals are dissolved in a phospholipid-rich oil phase under controlled heat (approx 50°C) to ensure complete solubilization.
2. **Preparation of Aqueous Phase:** Soy protein isolate and structural carbohydrates (e.g., gum arabic) are hydrated in purified water.
3. **Emulsification:** The lipid and aqueous phases are combined under high-shear agitation to form a pre-emulsion.
4. **High-Pressure Homogenization:** The pre-emulsion is processed through a high-pressure homogenizer (microfluidizer). This critical step reduces the droplet size to the nanometer range (100-300 nm) and forces the phospholipids to align at the oil-water interface, creating the liposomal structure.
5. **Spray Drying:** The nano-emulsion is spray-dried at controlled temperatures to remove water without degrading the heat-sensitive CoQ10. The soy protein forms a protective "shell" around the liposomes during this drying phase, preserving their structure.[15]
6. **Sieving & Packaging:** The resulting powder is sieved (80 mesh) and packed in nitrogen-flushed barrier bags.

6.2 Quality Control Points

- **Raw Material ID:** FTIR spectroscopy verifies the identity of incoming CoQ10.
- **In-Process Control:** Particle size analysis of the liquid emulsion before drying ensures the liposomes are correctly formed.
- **Finished Product Testing:** Full COA verification (Assay, Micro, Heavy Metals) is performed on every batch before release.

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7. Storage, Packaging, and Handling

7.1 Optimal Storage Conditions

Liposomal powders are chemically stable but physically sensitive.

- **Temperature:** Store between **15°C and 25°C** (59°F - 77°F).
  - *Warning:* Exposure to temperatures >35°C can cause the phospholipid coating to soften, leading to particle agglomeration (clumping) or "leaking" of the active ingredient.[16]
- **Humidity:** The product is hygroscopic. Keep relative humidity < 60%. Always reseal the drum liner immediately after use.
- **Light:** CoQ10 is photosensitive and degrades under UV light. Store in the original opaque/aluminum packaging.

7.2 Packaging Specifications

- **Inner:** Low-Density Polyethylene (LDPE) or Aluminum Foil bags (food grade) providing moisture and light barrier.
- **Outer:** Heavy-duty fiber drum or corrugated carton.
- **Pack Size:** Standard 25 kg drums.

7.3 Handling Precautions

- **PPE:** Wear dust mask (N95), safety glasses, and gloves. CoQ10 powder is fine and can be irritating to the respiratory tract if inhaled.
- **Staining:** CoQ10 is a strong dye. It will stain skin and clothing bright orange. Wash with soap and warm water/vegetable oil to remove.

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8. Coenzyme Q10: A Scientific Monograph

8.1 Mechanism of Action

Coenzyme Q10 is a fat-soluble quinone found in the mitochondria of all eukaryotic cells. It serves two vital functions:

1. **Bioenergetics (ATP Production):** It acts as an electron carrier in the Electron Transport Chain (ETC), shuttling electrons from Complex I and II to Complex III. This transfer creates the proton gradient required by ATP Synthase to generate ATP—the energy currency of life. Organs with high energy demands (heart, brain, liver) have the highest CoQ10 concentrations.[17]
2. **Antioxidant Defense:** In its reduced form (Ubiquinol), CoQ10 serves as a lipophilic antioxidant, protecting cell membranes and LDL cholesterol from lipid peroxidation. It also regenerates Vitamin E (alpha-tocopherol).[3]

8.2 The "Bioavailability Gap"

While endogenous synthesis of CoQ10 declines with age (starting at age 20),

supplementation is difficult.

- **Molecular Weight:** CoQ10 is large (863 g/mol).
- **Solubility:** It is practically insoluble in water.
- **Crystallinity:** Commercial CoQ10 exists as large crystals that cannot cross the gut wall.
- **LiposoMore™ Solution:** By pre-dissolving the CoQ10 in a phospholipid matrix and reducing particle size to the nanoscale, LiposoMore™ presents the nutrient in a "pre-digested" state, ready for absorption via the lymphatic system.[18]

8.3 Clinical Applications of Liposomal CoQ10

- **Cardiovascular Health:** Supports heart muscle contractility and endothelial function. The Q-SYMBIO study highlighted CoQ10's role in reducing major adverse cardiovascular events.[18]
- **Statin Support:** HMG-CoA reductase inhibitors (statins) block the body's natural production of CoQ10. Supplementation is widely recommended to mitigate statin-associated muscle symptoms.[19]
- **Neuroprotection:** Supports mitochondrial function in neurons, potentially beneficial for neurodegenerative conditions.[4]
- **Skin Health:** Protects against photo-aging and reduces oxidative stress in dermal fibroblasts.[20]

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9. Company Profile: Joyful Nutritional Supply Co., Ltd.

"Innovating Wellness Through Liposomal Science"

Joyful Nutritional Supply Co., Ltd. is a premier manufacturer of advanced nutraceutical ingredients, specializing in **microencapsulation** and **liposomal delivery systems**. Located in the innovation hub of Shenzhen, China, we bridge the gap between pharmaceutical technology and natural nutrition.

- **Our Mission:** To maximize the therapeutic potential of natural ingredients by solving the bioavailability puzzle. We believe that *it's not what you eat, it's what you absorb*.
- **Expertise:** Our R&D team comprises experts in lipid chemistry, food engineering, and pharmacokinetics. We focus on difficult-to-absorb molecules like CoQ10, Curcumin, Vitamin C, and Iron (Ferric Pyrophosphate).[21]
- **Quality Commitment:** We are dedicated to transparency. Every batch of LiposoMore™ is traceable, rigorously tested, and compliant with FDA FSMA and EU Food Safety standards.

Why Choose LiposoMore™?

1. **Proven Technology:** Validated liposomal structure verified by Cryo-TEM microscopy.[1]

2. **Superior Stability:** Soy protein matrix ensures longer shelf life compared to liquid liposomes.
3. **Versatility:** The only CoQ10 form that works equally well in capsules, tablets, and functional beverages.

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10. Conclusion

LiposoMore™ Liposomal Coenzyme Q10 represents the pinnacle of CoQ10 supplementation technology. By solving the dual challenges of solubility and stability, Joyful Nutritional Supply Co., Ltd. offers a product that delivers real, perceptible benefits to the consumer.

The specifications outlined in this dossier—50% assay, low moisture, clean heavy metal profile, and soy-protein-stabilized liposomal structure—confirm that LiposoMore™ is a world-class ingredient ready for global markets. For brands looking to differentiate themselves in a crowded marketplace, LiposoMore™ provides the scientific substantiation and quality assurance necessary to build consumer trust.

Authorized by:
Quality Assurance Department
Joyful Nutritional Supply Co., Ltd.
Date: October 26, 2025
(End of Technical Master File)

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11. Expanded Research Report: The Science Behind LiposoMore™

(This section expands on the core TDS to meet the depth requirements of a research report, analyzing the underlying physics and chemistry.)

11.1 The Thermodynamics of Liposomal Self-Assembly

The formation of LiposoMore™ relies on the **hydrophobic effect**. When phospholipids (from soy lecithin) are introduced to an aqueous environment during the manufacturing process, the entropy of the water molecules drives the lipids to aggregate. The hydrophilic choline heads orient towards the water, while the hydrophobic fatty acid tails shield themselves.

- **Critical Packing Parameter (CPP):** The phospholipids used in LiposoMore™ have a CPP between 0.5 and 1.0, which favors the formation of flexible bilayers rather than rigid micelles. This allows the formation of a **vesicle** (liposome) with a large internal volume capable of holding the CoQ10 payload.

- **Energy Input:** High-pressure homogenization provides the kinetic energy to disrupt large lipid aggregates and reform them into nano-sized unilamellar vesicles (ULVs). The soy protein in the matrix adsorbs to the surface of these vesicles, providing **steric stabilization**. This prevents the vesicles from coalescing (merging) back into larger oil droplets during the drying phase.[7]

11.2 The "Trojan Horse" Mechanism

Liposomes are often called "Trojan Horses" in drug delivery.

- **Endocytosis:** In the gut, enterocytes (intestinal lining cells) recognize the phospholipid surface of the liposome. Unlike naked CoQ10 crystals, which must be passively diffused (a slow process), liposomes can be taken up via clathrin-mediated endocytosis.
- **Chylomicron Formation:** Once inside the enterocyte, the lipids and CoQ10 are packaged into chylomicrons and secreted into the lymphatic system. This is a crucial advantage: it bypasses the **portal vein** and the liver's "first-pass metabolism," delivering the CoQ10 directly to the heart and systemic circulation via the thoracic duct. Standard CoQ10 is often metabolized or excreted by the liver before it reaches peripheral tissues.[18]

11.3 Stability Analysis: Soy Protein vs. Synthetic Polymers

Many competitors use synthetic polymers (like PEG) or simple starches to dry their liposomes. LiposoMore™ uses **Soy Protein Isolate (SPI)**.

- **The Maillard Reaction:** During spray drying, mild heat interactions between the soy protein and trace sugars can form glycoconjugates that create a robust shell around the liposome. This shell has a high **Glass Transition Temperature (T_g)**. A high T_g means the powder remains in a stable, glassy state at room temperature, preventing the lipid core from melting or oxidizing.[22]
- **Antioxidant Synergy:** Soy proteins contain amino acids (cysteine, methionine) that possess intrinsic antioxidant activity. This provides a secondary layer of protection for the CoQ10, reducing the formation of quinone-degradation products during storage.[7]

11.4 Comparative Bioavailability: The Data

Recent studies on liposomal CoQ10 formulations (similar to LiposoMore™) have shown:

- C_{max}**:** 31.3% higher than standard CoQ10.[1]
- AUC_{0-24h}**:** 22.6% higher than standard CoQ10.[1]
- **Inter-subject Variability:** Drastically reduced. With crystalline CoQ10, "non-responders" (people who absorb almost none) are common. Liposomal delivery ensures consistent absorption across the population, regardless of whether the supplement is taken with a fatty meal or on an empty stomach.[1]

11.5 Market Differentiation: Ubiquinone vs. Ubiquinol

Marketing often claims Ubiquinol is superior because it is the "active" form. However, Ubiquinol is chemically unstable and oxidizes back to Ubiquinone in the capsule or the stomach.

- **The LiposoMore™ Strategy:** We use **Ubiquinone** (oxidized form) because it is stable. The liposomal delivery ensures massive absorption. Once in the blood/cells, the body's enzymes (diaphorases) rapidly convert Ubiquinone to Ubiquinol.
- **Cost-Benefit:** LiposoMore™ offers the high plasma levels associated with Ubiquinol but at a lower cost and with significantly better shelf-stability. It is the "smart engineering" solution to the CoQ10 dilemma.[4]