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: LiposoMore™ M-K2 (Liposomal Vitamin K2 MK-7 Powder)

Product Identity and Technical Overview

The nutrient landscape has undergone a significant paradigm shift from basic supplementation toward precision delivery systems. LiposoMore™ M-K2, manufactured by Joyful Nutritional Supply Co., Ltd., represents the zenith of this evolution, offering a stabilized, highly bioavailable form of Vitamin K2 as Menaquinone-7 (MK-7).[1] Vitamin K is a group of fat-soluble vitamers essential for the biosynthesis of proteins involved in blood coagulation, bone metabolism, and the regulation of vascular calcification.[2] While Vitamin K1 (phylloquinone) is the primary dietary form found in leafy greens, Vitamin K2 (menaquinone) is produced by bacterial fermentation and is characterized by structurally variable isoprenoid side chains, designated as MK-n.[2]

Among the menaquinones, MK-7 is widely recognized as the most bioactive and effective form due to its superior lipophilicity and remarkably long half-life in human circulation.[2] However, the efficacy of traditional MK-7 supplements is often hampered by poor absorption in the gastrointestinal tract and significant stability issues when exposed to light, heat, or alkaline minerals like calcium and magnesium.[6] LiposoMore™ M-K2 utilizes advanced liposomal encapsulation technology to address these challenges, coating the active MK-7 in a hydrophobic phospholipid bilayer to create a microencapsulated powder that ensures both environmental protection and direct cellular delivery.[1]

The Molecular Architecture of Menaquinone-7 (MK-7)

Menaquinone-7, or MK-7, is a long-chain menaquinone consisting of a 2-methyl-1,4-naphthoquinone ring structure—common to all K-vitamins—and a side chain of

seven isoprene units.[2] The chemical formula for this molecule is $C_{46}H_{64}O$, with a molecular weight of approximately $649.00\ \mathrm{g/mo}$.[4] The side chain length is the critical determinant of the vitamer's pharmacokinetic profile; longer chains increase lipophilicity, which facilitates incorporation into lipoproteins and extends the circulating time in the blood.[2]

Property	Value/Description	Scientific Significance
Common Name	Vitamin K2 as MK-7	Standard nomenclature for menaquinone-7.[4]
Chemical Name	2-methyl-3-farnesylgeranylgeranyl-1,4-naphthoquinone	Precise IUPAC identification.[4]
Molecular Formula	$C_{46}H_{64}O$	Structural stoichiometry for analytical verification.[12]
Molecular Weight	$649.00\ \mathrm{g/mo}$	Basis for molar calculations in clinical settings.[12]
CAS Number	2124-57-4	Unique chemical identifier.[12]
Configuration	All-trans isomer	The biologically active form required for protein activation.[6]

The preservation of the "all-trans" configuration is paramount, as this isomer is the only form capable of serving as a cofactor for the enzyme γ-glutamylcarboxylase.[6] Poorly manufactured synthetic forms may contain cis-isomers, which are biologically inert. LiposoMore™ M-K2 is produced via natural fermentation, ensuring a high-purity, all-trans profile that maximizes therapeutic efficacy.[6]

Liposomal Encapsulation Technology: A Precision Delivery Platform

The core technological advantage of LiposoMore™ M-K2 lies in its liposomal carrier system. Liposomes are self-assembling, spherical vesicles composed of one or more phospholipid bilayers that mimic the structure of human cell membranes.[18] By encapsulating MK-7 within these lipid layers, LiposoMore™ M-K2 transforms a hydrophobic nutrient into a highly

dispersible and stable microencapsulated powder.[1]

Mechanism of Action and Cellular Uptake

Conventional fat-soluble vitamins require dietary fats and bile salts to form micelles before they can be absorbed through the intestinal wall—a process that is often inefficient and highly variable.[6] Liposomes bypass this requirement. Due to their phospholipid composition, they can merge directly with the membranes of the enterocytes (intestinal cells) or be taken up via endocytosis, allowing the nutrient to enter the lymphatic system and eventually the bloodstream without significant degradation.[6] This "Trojan horse" mechanism ensures that a higher percentage of the dose reaches the target tissues intact.[6]

Protection Against Gastrointestinal Stressors

The phospholipid shell acts as a physical barrier, shielding the sensitive MK-7 molecule from the harsh acidic environment of the stomach and the various digestive enzymes in the duodenum.[6] This protection is particularly vital for individuals with sensitive digestion or conditions like celiac or Crohn's disease, which typically impair the absorption of fat-soluble vitamins.[5]

Comparative Pharmacokinetics: Why Delivery Matters

The efficacy of Vitamin K2 is directly linked to its persistence in the blood. While Vitamin K1 and MK-4 are rapidly cleared by the liver, MK-7 exhibits a prolonged circulation time that allows for consistent activation of extrahepatic proteins in the bones and vasculature.[2]

Half-Life and Bioavailability Analysis

MK-7's remarkably long half-life—approximately 72 hours—contrasts sharply with MK-4's half-life of only about one hour.[2] This extended duration means that MK-7 remains available to tissues like the arteries and bones for days, whereas other forms are gone in hours.[4]

Vitamer	Half-Life	Bioavailability	Tissue Distribution
Vitamin K1	~1.5 - 7.5 Hours	Moderate	Primarily hepatic.[2]
Vitamin K2 (MK-4)	~1 Hour	Poor	Limited.[2]
Vitamin K2 (MK-7)	~72 Hours	High	Systemic (Bones, Arteries).[2]
LiposoMore™ M-K2	**Enhanced**	**Superior**	**Cell-targeted /**

			Sustained.[6]

Clinical studies comparing equal nutritional doses of MK-4 and MK-7 have demonstrated that while MK-7 is well-absorbed and increases serum levels significantly, MK-4 often remains undetectable in the blood after administration.[4] Liposomal encapsulation further amplifies these inherent advantages by increasing the maximum plasma concentration (C_{max}) by up to 5.4 times compared to non-encapsulated forms.[21]

Biological Functionality: Bone Health and Arterial Protection

LiposoMore™ M-K2 serves as a critical biological "traffic controller" for calcium. Its primary role is to activate proteins that direct calcium to the bones while keeping it out of the soft tissues and arteries.[3]

Carboxylation of Osteocalcin for Bone Density

In the skeletal system, Vitamin K2 is required for the γ-carboxylation of osteocalcin, a protein produced by osteoblasts.[3] Once carboxylated, osteocalcin binds calcium ions to the hydroxyapatite matrix, strengthening bone mineral density (BMD) and bone mineral content (BMC).[11] A clinical study involving 244 healthy postmenopausal women found that regular MK-7 supplementation significantly decreased the age-related decline in bone mass density at the femoral neck and lumbar spine.[4]

Matrix Gla Protein and Cardiovascular Integrity

Perhaps the most crucial function of MK-7 is the activation of Matrix Gla Protein (MGP) in the arterial walls.[3] MGP is the most potent known inhibitor of soft-tissue calcification.[11] Without sufficient Vitamin K2, MGP remains in its uncarboxylated, inactive form (ucMGP), allowing calcium to deposit in the arteries, leading to arterial stiffness and cardiovascular disease.[16] Long-term clinical data from the Rotterdam Study and other trials have unequivocally shown that high intake of menaquinone is associated with a reduced risk of coronary heart disease and significant improvements in arterial elasticity.[11]

Technical Specifications and Product Standards

LiposoMore™ M-K2 is manufactured under a rigorous "In-house Standard" that ensures every batch meets specified limits for potency, purity, and safety.[1] The following specifications are representative of the product's high-quality profile.

Physical and Chemical Characteristics

Parameter	Specification	Actual Performance	Method
Appearance	Light yellow powder	Pass	Visual.[1]
Odor	Odorless	Pass	Organoleptic.[1]
Solubility	Dispersible in water	Pass	Gravimetric.[1]
Assay (Vitamin K2)	≥0.15	0.16%	HPLC/UPLC.[1]
Loss on Drying	＜10.0%	1.5%	$105^{\circ}C$ / 4h.[1]
Bulk Density	0.3-0.55g/ml	Complies	USP .[13]

The water-dispersible nature of this liposomal powder makes it an ideal ingredient for a wide array of dosage forms, including clear liquids, effervescent tablets, and functional beverages, where traditional oil-based K2 would fail to disperse.[10]

Toxicological Standards: Heavy Metals

Heavy metal contamination is a significant concern for fermented ingredients. LiposoMore™ M-K2 is tested via Inductively Coupled Plasma Mass Spectrometry (ICP-MS) to ensure compliance with the strictest safety guidelines.[1]

Heavy Metal	Limit	Testing Standard
Total Heavy Metals	＜10ppm	ICP-MS.[1]
Lead (Pb)	＜3ppm	ICP-MS.[1]
Mercury (Hg)	＜0.1ppm	ICP-MS.[1]
Cadmium (Cd)	＜1.0ppm	ICP-MS.[1]
Arsenic (As)	＜1.0ppm	ICP-MS.[1]

Microbiological Quality Control

To guarantee product safety, LiposoMore™ M-K2 undergoes comprehensive microbial screening according to USP 2021 and 2022 methodologies.[1]

Test Item	Specification	Testing Method
Total Plate Count	<	USP 2021.[1]
Molds & Yeasts	<100cfu/g	USP 2021.[1]
E. Coli	Negative in 10 g	USP 2022.[1]
Salmonella	Negative in 25 g	USP 2022.[1]
Staphylococcus Aureus	Negative in 10 g	USP 2022.[1]

Stability Dynamics and Formulation Advantages

A recurring challenge for Vitamin K2 is its instability when formulated with minerals like calcium carbonate or magnesium oxide.[7] In traditional multivitamin blends, non-encapsulated K2 can lose up to 70% of its activity within a year due to alkaline degradation.[7]

The Protective Role of the Liposomal Matrix

LiposoMore™ M-K2 solves this "stability gap" by providing a physical phospholipid barrier that prevents direct contact between the MK-7 molecule and reactive mineral surfaces.[8] This makes it the preferred choice for complex bone health formulas that combine Vitamin K2 with high doses of calcium and magnesium.[8]

Stress Factor	Effect on Regular K2	LiposoMore™ M-K2 Performance
Light Exposure	Rapid decomposition.[8]	Shielded by lipid bilayer.[10]
Alkaline Minerals	High degradation rate.[7]	Physically separated by microcapsule.[10]

Moisture/Humidity	Promotes oxidation.[9]	Phospholipids regulate water activity.[9]
Heat	Accelerates potency loss.[9]	Phospholipid shell provides thermal stability.[10]

Manufacturing Excellence: Joyful Nutritional Supply Co., Ltd.

The quality of LiposoMore™ M-K2 is backed by the technical expertise of Joyful Nutritional Supply Co., Ltd., a leader in the field of liposomal ingredients.[1] Based in the high-tech hub of Shenzhen, China, the company integrates cutting-edge nanotechnology with pharmaceutical-grade quality management systems.[1]

- **Manufacturing Standards**: Production is conducted in facilities that adhere to current Good Manufacturing Practices (cGMP), ensuring that every step—from raw material sourcing to final packaging—is documented and controlled.[29]
- **ISO Verification**: The facility maintains ISO 9001 and ISO 22000 certifications, demonstrating a global commitment to quality management and food safety.[16]
- **In-house Innovation**: Joyful Nutritional Supply utilizes proprietary microencapsulation techniques that optimize the particle size and zeta potential of the liposomes, ensuring long-term dispersion stability and maximum absorption.[9]

Regulatory Compliance and "Clean Label" Declarations

In alignment with the demands of premium supplement brands, LiposoMore™ M-K2 is formulated to meet the highest global compliance standards for safety and labeling accuracy.[17]

Comprehensive Compliance Statements

Statement	Verification Status	Rationale
Non-GMO	Verified	Produced without genetically modified organisms.[10]
Gluten-Free	Verified	Contains no wheat, barley, or rye; gluten content

		< .[33]
BSE/TSE Free	Verified	No animal-derived ingredients used; no risk of spongiform encephalopathies.[32]
Soy-Free	Verified	Free from soy proteins and allergens.[7]
Allergen-Free	Verified	No milk, eggs, fish, shellfish, or tree nuts.[4]
Vegan/Vegetarian	Verified	100% plant-based formulation.[10]

These declarations provide brand owners with the necessary documentation to support "free-from" claims on final product labels, which is a critical driver of consumer trust in the modern market.[16]

Safety Profile and Highest Observed Intake (HOI)

Vitamin K2 (MK-7) has a robust safety record. Unlike the fat-soluble vitamins A and D, Vitamin K does not have a high potential for toxicity, as it is not stored in large amounts in the liver.[4]

- **Clinical Safety**: More than 40 human clinical trials evaluating doses up to $462\ \mu g/\text{day}$ have reported no serious adverse effects.[2]
- **CRN Guidance**: The Council for Responsible Nutrition (CRN) has established a Highest Observed Intake (HOI) of $375\ \mu g/\text{day}$ for MK-7 supplements in adults.[36]
- **Contraindications**: Because Vitamin K2 acts as a cofactor for clotting proteins, it may counteract the effect of Vitamin K antagonists (VKA) like warfarin. Patients on blood-thinning therapy should consult a physician before use.[2]

Storage, Packaging, and Shelf-Life Guidelines

The delicate nature of phospholipids and MK-7 requires specialized storage and packaging to maintain the 24-month shelf life of LiposoMore™ M-K2.

Packaging Configuration

The standard packaging is designed to provide a multi-layered defense against moisture, oxygen, and light:

- **Primary Packaging**: Food-grade polyethylene zip-lock bag for an airtight internal environment.[13]
- **Secondary Packaging**: Silver, aluminum-based doypack, which provides an absolute barrier to UV light and ambient humidity.[13]

Storage Requirements

To preserve the liposomal structure and ensure 100% potency:

- **Temperature**: Store in a cool place between $5^{\circ}C$ and $25^{\circ}C$ ($41^{\circ}F - 77^{\circ}F$).[8]
- **Humidity**: Maintain an environment with $30 - 50\%$ relative humidity.[13]
- **Light**: The product is highly light-sensitive. Always keep in the provided light-shielding packaging.[8]
- **Caution**: Avoid freezing, as the formation of ice crystals can rupture the phospholipid vesicles, leading to a loss of the liposomal delivery advantage.[40]

Application Versatility in Functional Products

The powder form of LiposoMore™ M-K2, combined with its water-dispersibility, offers product developers unparalleled flexibility across various industry segments.[10]

Finished Product Compatibility

Dosage Form	Compatibility	Key Advantage
Vegetarian Capsules	Excellent	Precise dosing with high-purity, all-trans K2.[10]
Tablets	High	Liposomal coating survives the compression process.[10]
Effervescent Tablets	Excellent	Instant dispersion without oily residue.[10]
Softgel Capsules	High	Can be suspended in various oil bases for combined formulas.[10]
Functional Powders	Excellent	Ideal for protein blends or meal replacements.[10]

Gummies	High	Stable at processing temperatures.[10]

Synergistic Potential: The Vitamin D3 and K2 Interaction

The most common application for LiposoMore™ M-K2 is in combination with Vitamin D3. These two vitamins work in a synergistic loop: Vitamin D3 increases the absorption of calcium from the diet, while Vitamin K2 ensures that this absorbed calcium is deposited in the bones rather than the arteries.[15] Clinical evidence suggests that combined supplementation achieved a 91.67% complete bone fusion rate compared to 74.29% in control groups, emphasizing the power of this nutritional duo.[21]

Conclusion: The LiposoMore™ Advantage

LiposoMore™ M-K2 represents the fusion of biological necessity and technological innovation. By transforming Vitamin K2 (MK-7) into a stable, highly bioavailable liposomal powder, Joyful Nutritional Supply Co., Ltd. has created an ingredient that addresses the core limitations of traditional supplementation.

For brand owners and formulators, LiposoMore™ M-K2 offers a guaranteed solution for potency retention in complex mineral formulas, a clean-label profile for health-conscious consumers, and a pharmacokinetic profile that maximizes the health benefits for the end-user. Whether the goal is to support lifelong bone strength or to preserve cardiovascular health, LiposoMore™ M-K2 provides the precision delivery required for modern, effective nutrition.