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Micro Encapsulation for Foods & Nutraceuticals Ingredients

Basic conceptual technology

Types of microencapsulation

and Its Advantages

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1 MICROENCAPSULATION OFFERS PROTECTION TO FRAGILE ACTIVE NUTRIENTS AGAINST DAMAGING ENVIRONMENTAL FACTORS

ENVIRONMENTAL FACTORS THAT CAN DAMAGE ACTIVE NUTRIENTS

O_2 OXYGEN
Oxidation degrades active nutrients

Degradation & loss of potency

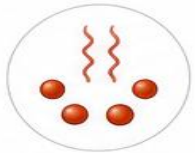
HUMIDITY
Moisture causes hydrolysis or clumping

Reduced stability & effectiveness

SUN LIGHT
UV rays break down sensitive compounds

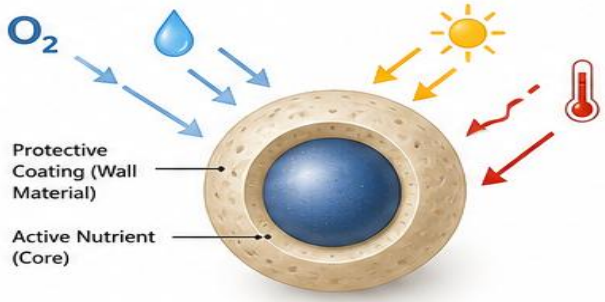
Photo-degradation & quality loss

HEAT
High temperature degrades actives



Loss of activity & potency

MICROENCAPSULATED ACTIVE NUTRIENT



The protective coating acts as a shield, preventing penetration of harmful factors and preserving the integrity & potency of active nutrients.

KEY BENEFITS

- Prevents oxidation and degradation
- Protects from moisture & humidity
- Shields from UV radiation
- Improves thermal stability
- Enhances shelf life
- Maintains efficacy and potency
- Ensures consistent performance

2 MICROENCAPSULATION OFFERS PROTECTION WITH NON COMPATIBLE REACTING ACTIVE COMPOUNDS IN FORMULATIONS

(Example: Iodine & Iron Compounds in Common Salt)

WITHOUT MICROENCAPSULATION

Iodine (Active) + Iron Compounds (in Salt)

Chemical Reaction Occurs

Iodine reacts with Iron and becomes inactive

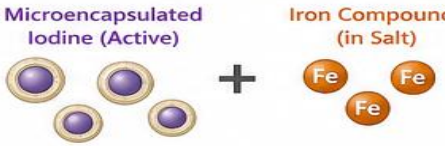
Result

Loss of iodine activity, reduced nutritional benefit

- Active nutrient degraded
- Reduced product efficacy
- Unreliable & inconsistent results
- Lower shelf life

WITH MICROENCAPSULATION

Microencapsulated Iodine (Active) + Iron Compounds (in Salt)



No Direct Contact – Reaction Prevented

Coating prevents interaction between iodine and iron compounds

Result

Iodine remains stable & active, iron remains unreacted

- Active nutrient protected
- Maintains full efficacy
- Consistent quality & performance
- Longer shelf life

MICROENCAPSULATION = PROTECTION + STABILITY + EFFECTIVENESS

Preserves the purity, potency and performance of active nutrients in the face of environmental stress and incompatible ingredients.

TYPES OF MICROENCAPSULATION

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- **Matrix Coating** : Spray drying, Hot melt extrusion, Granulation etc.
- **Seal Coating**: Using Fluidized bed processor, Pan coating, Liposomal coating, molecular coating, coating by congealing & coating by co acerbation etc.
- **Modified Coating**: Using Fluidized bed processor & Pan coating.
- **Customized Coatings :** By using the creative combination of more than 1 microencapsulation technologies.

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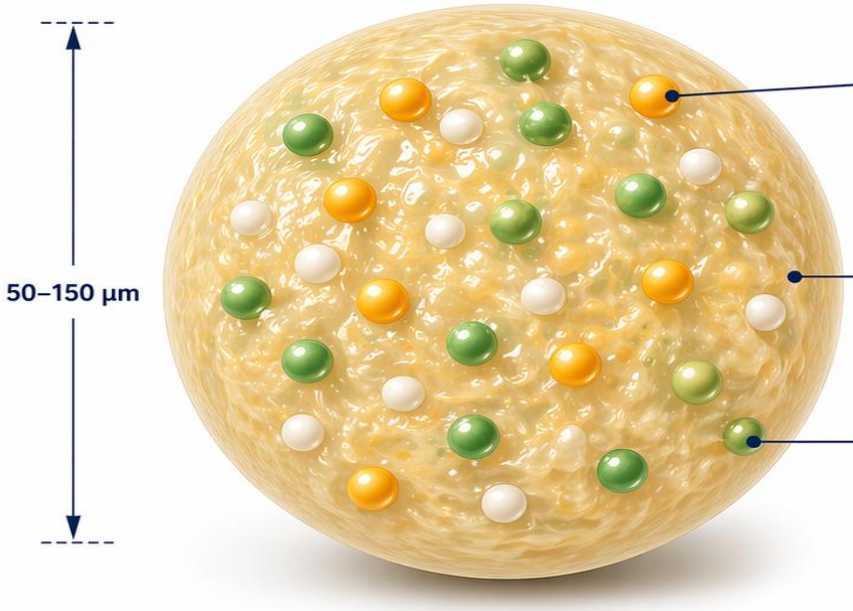
MATRIX COATED NUTRIENT PARTICLE

(Cross Section)



ACTIVE NUTRIENT
(Vitamin)
Uniformly dispersed within the matrix.

MATRIX (POLYMER NETWORK)
Food-grade polymers form a 3D network that entraps and protects the nutrient.

EXCIPIENTS / FILLERS
Support matrix structure and stability.

- Active Nutrient (Vitamin)
- Excipients / Fillers
- Other Components

KEY FEATURES

- ✓ Active nutrient is uniformly dispersed throughout the polymer matrix.
- ✓ Protects from moisture, oxygen, light & processing stresses.
- ✓ Enables controlled release in the gastrointestinal tract for better absorption.
- ✓ Improves stability, shelf life and bioavailability.

Protected.
Stable.
Better Absorbed.

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MATRIX COATING OF VITAMIN A USING MALTODEXTRIN

Loss of Vitamin A occurs in the initial 7 to 10 days due to Vitamin A present on the surface of dried matrix particles

1 ACTIVE CORE

Vitamin A (retinyl palmitate) as the active nutrient

Vitamin A

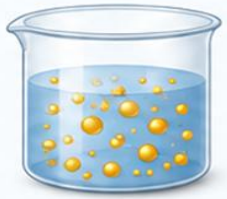
2 PREPARATION OF MATRIX

Maltodextrin solution (wall material)

Maltodextrin

3 EMULSION / DISPERSION

Vitamin A is dispersed in maltodextrin solution



Oil-in-water dispersion

4 DRYING (SPRAY DRYING)

Water is removed and matrix coating forms around Vitamin A

Drying forms matrix-coated particles

5 MATRIX COATED VITAMIN A PARTICLES

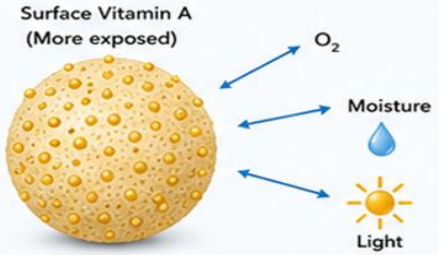
Dried matrix-coated Vitamin A particles

MATRIX COATING BENEFITS

- Protects Vitamin A from oxidation, moisture & light
- Improves stability during storage
- Controlled release of Vitamin A
- Easy to handle powder form

INITIAL LOSS OF VITAMIN A (FIRST 7 TO 10 DAYS)

Vitamin A present on the surface of the dried matrix particles is more exposed to oxygen, moisture and light, leading to faster loss during the initial storage period.



WHAT HAPPENS IN FIRST 7–10 DAYS?

Day 0

Some Vitamin A present on the surface

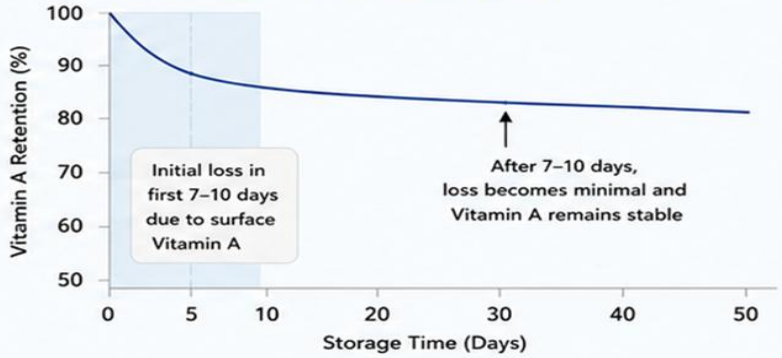
Day 7–10

Surface Vitamin A is lost due to environmental exposure

After 7–10 Days

Loss stabilizes. Entrapped Vitamin A remains well protected

TYPICAL VITAMIN A LOSS CURVE



KEY TAKEAWAY

Matrix coating with maltodextrin protects Vitamin A by encapsulating it. However, some Vitamin A on the surface of dried particles is exposed, causing loss in the initial 7 to 10 days. After this period, stability is significantly improved.

BEST PRACTICES TO MINIMIZE INITIAL LOSS

- Optimize drying conditions
- Increase maltodextrin concentration
- Add antioxidants (e.g., BHT, tocopherols)
- Use inert packaging
- Store in cool, dry, dark conditions

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CROSS SECTION OF HOT MELT SEAL COATED NUTRIENT

HOT MELT SEAL COAT
Outer sealing layer.
Provides moisture protection, improved shelf stability and barrier to the core.

NUTRIENT CORE
Contains the active ingredient(s) and excipients.

CORE SURFACE
Surface of the nutrient core to which the coating is applied.

Hot melt seal coating is a manufacturing process in which a molten coating material is applied to the coated core and solidifies to form a smooth, protective seal layer.

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MECHANISM OF 35% YEAST REDUCTION IN BREAD MAKING USING COATED SORBIC ACID

1 DURING WET MIXING & FERMENTATION

Coated sorbic acid does not kill fermenting yeast

Uncoated sorbic acid (conventional)
requires normal yeast level

- Yeast cell
- Sorbic acid
- Coated sorbic acid (fat seal)

Coated sorbic acid in dough
(during wet mixing)

Fat seal coating prevents sorbic acid from contacting yeast.
Yeast remains alive and active.

Lower input of yeast
achieves the same amount of fermentation & dough rise as with normal yeast level

Same fermentation,
same dough performance

KEY OUTCOME

Because coated sorbic acid does not kill fermenting yeast during mixing & fermentation,
lower input of yeast (up to 35% less)
can produce the same fermentation and dough quality as conventional (uncoated) sorbic acid.

2 DURING BAKING & SHELF LIFE

Yeast dies at 65°C while coating opens at the same temperature

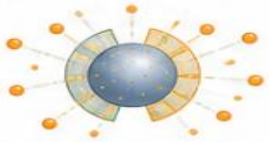
In the oven
Temperature rises

Temperature reaches 65°C

At ~65°C
Yeast dies

Yeast cells lose activity and become inactive (almost sterile bread).

At ~65°C
Fat seal coating opens



Fat seal melts and opens, releasing sorbic acid inside the bread.

After baking
Sorbic acid is now active

Released sorbic acid inhibits any surviving yeast or mold growth.

Result
Longer shelf life

Almost sterile bread + active sorbic acid = longer shelf life

SUMMARY OF THE DUAL ACTION

35% LESS YEAST

1 **During mixing & fermentation**
Coated sorbic acid does not kill fermenting yeast.
Lower yeast input (up to 35%) **gives same fermentation.**

+

2 **During baking & after baking**
Yeast dies at 65°C.
Coating opens at the same temperature and releases sorbic acid.
Provides longer shelf life.

=

SAME QUALITY
BETTER SHELF LIFE
COST OPTIMIZATION
with 35% less yeast

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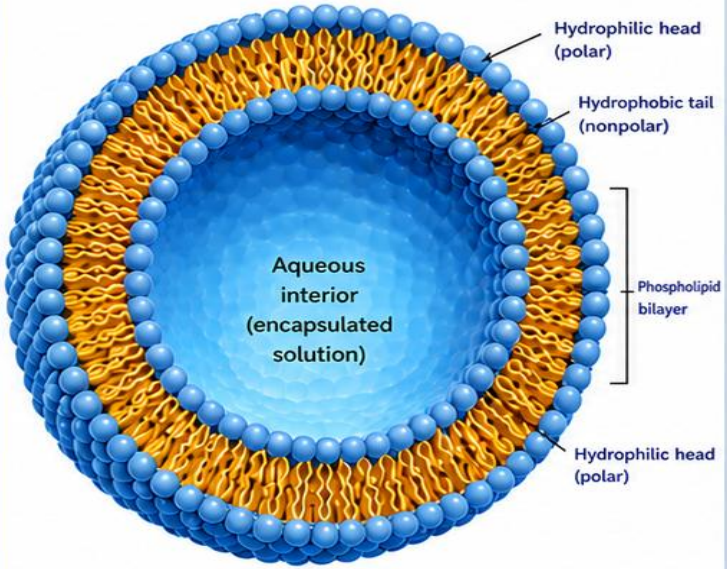
BILAYER LIPOSOME STRUCTURE & CELLULAR UPTAKE MECHANISM

BILAYER LIPOSOME STRUCTURE



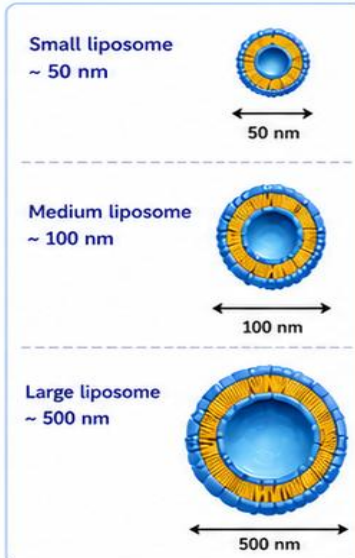
For scale comparison:

SIZE DIMENSIONS

Typical diameter range:

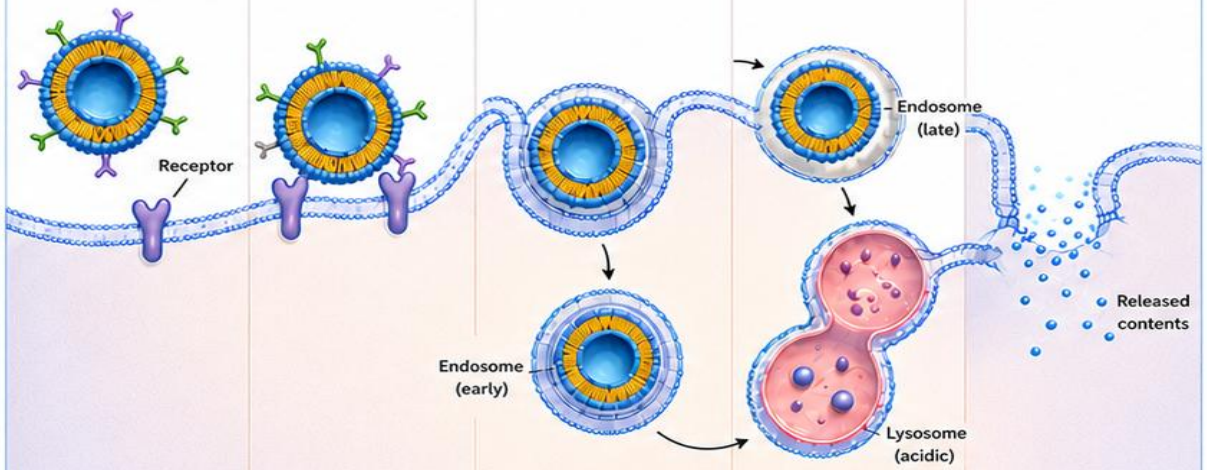
50 nm – 500 nm

(nanometers)



ABSORPTION MECHANISM IN HUMAN CELL (ENDOCYTOSIS PATHWAY)

1. **Approach & Recognition** — Liposome approaches the cell membrane.
2. **Binding** — Surface ligands (if present) bind to cell surface receptors.
3. **Internalization (Endocytosis)** — The liposome is engulfed by the cell membrane, forming an endosome.
4. **Endosomal Trafficking** — The endosome may mature and fuse with lysosome.
5. **Release of Contents** — Liposome membrane disrupts and releases encapsulated contents into the cytoplasm.



Liposomes are versatile delivery systems used for drug delivery, gene therapy, imaging, vaccines, and **nutrients**.

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MICROENCAPSULATED VITAMIN INGREDIENT
WITH MATRIX & SEAL COATING (COMBINATION)

Superior Protection • Targeted Delivery • Maximum Nutritional Benefits

1. MATRIX COATING (First Layer)
Ingredient dispersed throughout the coating matrix

1 MIXING
Vitamin is uniformly mixed with food-grade coating polymers.

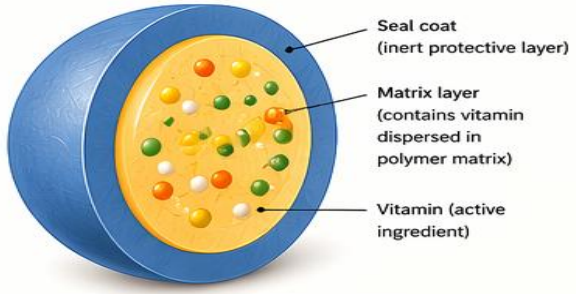
2 ENCAPSULATION
Mixture is pelletized or spray-dried to form matrix encapsulated particles.

3 DRYING / CURING
Moisture is removed and matrix is cured for stability.

MATRIX BENEFITS
- ✓ Controls release of vitamin
- ✓ Protects from moisture, oxygen & light
- ✓ Improves stability during processing & storage
- ✓ Enhances bioavailability

- Vitamin (active)
- Coating matrix
- Excipients / Fillers
- Seal coat layer

COMBINATION PRODUCT (CROSS SECTION)



Dual protection for superior stability, targeted release & maximum efficacy

2. SEAL COATING (Outer Layer)
Inert protective layer applied over matrix core

1 CORE PREPARATION
Matrix encapsulated vitamin particles used as core.

2 SEAL COATING
Inert coating material is applied to form a protective layer around the core.

3 DRYING / CURING
Coating is dried/ cured to form a stable, protective seal layer.

SEAL COATING BENEFITS
- ✓ Protects core from harsh environment
- ✓ Prevents loss & degradation during processing
- ✓ Improves flowability & handling
- ✓ Enables targeted release in the intestine

BENEFITS IN HUMAN DIGESTION SYSTEM

MOUTH
Protects vitamin during chewing and in early stages.

STOMACH
Coating protects from acidic pH and enzymes.

SMALL INTESTINE
Matrix controls release; Nutrients released gradually.

ABSORPTION
Targeted release improves absorption and bioavailability.

BENEFITS
Enhanced nutritional value, immunity, energy & overall well-being.

IDEAL FOR VITAMINS

A	C	D	E	B Complex	B12
Vision, Immunity, Skin Health	Immunity, Antioxidant Support	Bone Health, Calcium Absorption	Antioxidant, Skin & Cell Protection	Energy Metabolism, Nerve Health	Red Blood Cells, Brain & Nerve Function

APPLICATIONS

Functional Beverages | Dairy Products | Breakfast Cereals | Nutritional Bars | Dietary Supplements | Bakery & Confectionery

KEY ADVANTAGES OF COMBINATION (MATRIX + SEAL COATING)
- ✓ Dual-layer protection for superior stability
- ✓ Controlled & targeted release for better absorption
- ✓ Higher retention of vitamin potency
- ✓ Improved process tolerance (heat, shear, storage)
- ✓ Enhances shelf life and nutritional quality
- ✓ Better consumer health outcomes

SUITABLE COATING MATERIALS (FOOD GRADE)
- Matrix Layer: Modified starch, Maltodextrin, Gum arabic, Pectin, Proteins, Cellulose derivatives
- Seal Layer: HPMC, Pullulan, Zein, Shellac, Stearic acid, Waxes, Lecithin

MAXIMUM PROTECTION FROM ENVIRONMENTAL FACTORS | **TARGETED DELIVERY IN THE INTESTINE** | **ENHANCED BIOAVAILABILITY** | **STABLE DURING PROCESSING & EXTENDED SHELF LIFE** | **BETTER NUTRITIONAL VALUE & CONSUMER HEALTH BENEFITS**

ENCAPSOL
SHIELDED FOR PERFORMANCE

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Seal coating Technologies

Hot Melt Coating – Target Release

Created Products with Advantages

- **Encapsol Sorbic acid 80%** (bakery preservative) : Reduction in bakery yeast up to 35% & extension of shelf-life in bread.
- **Encapsol Propionic acid 80%** (bakery preservative) :Reduction in off odour. Enhancement in taste & mouth feel in cakes.
- **Encapsol Fumaric acid 80%.** (Tortilla preservative): Enhancement in shelf-life in tortilla
- **Encapsol Sodium bi carbonate 70%** (leavening agent):Targeted & controlled aeration in the instant mixes formulation.

Hot Melt Coating – Slow Release

Created Products with Advantages

- **Encapsol Fumaric acid 90%.** (Tortilla preservative) : Enhancement in shelf-life.
- **Encapsol Mono Calcium Phosphate 90%.**(leavening ingredient in baking powder): Effective in **100% removal of Sodium Acid Pyro phosphate** from baking powder.

LIPOVIN
DESIGNED FOR EFFICIENT NUTRIENT DELIVERY

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Liposome Technologies

Lipovin by double layering of fat (Minerals)

Created Products with Advantages

- **Lipovin Iron**
- **Lipovin Calcium**
- **Lipovin hydrolyzed vegetable protein**: Water soluble with neutral taste & no bitterness.

Advantages

- Lipovin Iron, Calcium are more bioavailable. Ideal for food fortification, enteral food formulations & for **food for special medical purposes**.

Lipovin by double layering of fat (Vitamins)

Created Products with Advantages

- **Lipovin Vitamin C**
- **Lipovin Vitamin E**
- **Lipovin containing mineral & vitamin**.

Advantages

- Lipovin mineral & vitamin reduces ingredients in the formulation . It also provide additional space for other actives , excipients in the formula.

OLEOMORPH
ENRICHING FUNCTIONALITY

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Matrix coating Technology

OLEOMORPH : Fat powder Vegan grade (Spray Dried)

Created Products

- MCT oil powder
- Coconut oil powder
- High Oleic Sunflower Fat powder
- Sunflower fat powder
- Canola fat powder
- Soyabean fat powder
- Customized blend of fat powders

Advantages

- Easy to use & store
- Simplified food formulations

OLEOMORPH : Fat powder Non Vegan grade(Spray Dried)

Created Products

- MCT oil powder
- Coconut oil powder
- High Oleic Sunflower Fat powder
- Sunflower fat powder
- Canola fat powder
- Soyabean fat powder
- Customized blend of fat powders

Advantages

- Easy to use & store
- Simplified food formulations

Summary

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Matrix coating technology

It involves embedding active nutrients uniformly within a food-grade carrier, providing strong protection against environmental stress factors heat, O2, Moisture & Sunlight. It enhances stability during processing & storage while enabling cost-effective large-scale fortification

Seal coating for target release:

It applies a protective outer layer that prevents premature interaction of nutrients with the food matrix & ensures controlled release at specific sites such as the intestine. It is effective in masking undesirable taste & odours, as well as preventing chemical interactions between incompatible ingredients like iron & iodine. It improves bioavailability while maintaining safety by reducing irritation & preserving nutrient integrity

Seal coating for slow release:

It is designed to gradually release nutrients over time, ensuring a steady & sustained availability within the body or food system. This helps in minimizing degradation losses during processing & avoids sudden spikes in nutrient concentration, which can impact efficacy. The controlled release profile supports better absorption

Liposomal encapsulation technology:

It uses phospholipid bilayer vesicles to encapsulate nutrients, offering superior protection & significantly enhanced absorption at the cellular level. It is particularly beneficial for sensitive vitamins, minerals, & antioxidants in aqueous systems. Technology is highly safe, digestion-friendly, & effective in improving overall bioavailability

Our presence

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