

Liposomes
and Emulsions

Natural Phospholipids

NEW

Innovative Encapsulation Systems
for Bioavailability Enhancement

















We Invest in Quality.

Lipoid Products for Innovative Dietary Supplements

Lipoid is expert in the development and industrial production of high-quality lecithin and phospholipids and the only company worldwide offering the whole range of phospholipids on an industrial scale. Phospholipids are natural raw materials with versatile applications and excellent tolerability^[1].

They can be used to prepare innovative formulations, most prominently liposomes and emulsions, that increase the bioavailability of the encapsulated active^[2,3]. In addition, pre-formulated empty delivery systems are available that can be customized with a variety of different active ingredients.

ORIGIN/PRODUCT	DESCRIPTION	APPEARANCE	APPLICATIONS
NON-GMO SOYBEAN			
LIPOID P 45	Lecithin fraction, phosphatidylcholine content ≥ 45 %		
LIPOID P 75	Phospholipids, phosphatidylcholine content ≥ 70 %		
SUNFLOWER (NON-GMO)			
LIPOID H 65	Phospholipids, phosphatidylcholine content ≥ 60 %		
LIPOID H 85	Phosphatidylcholine, phosphatidylcholine content ≥ 85 %		
LIPOID H 100	Phosphatidylcholine, phosphatidylcholine content ≥ 94 %		
NON-GMO PRE-FORMULATIONS			
LIPOID Liposome Basic	Liposome concentrate with 15 % phospholipids from soybean in glycerol		
PHOSAL® H 50	Sunflower phosphatidylcholine in sunflower oil, phosphatidylcholine content = 50 %		

Advantages

EXCELLENT TOLERABILITY

NATURAL EMULSIFIERS & DELIVERY SYSTEMS

COMPATIBLE WITH A WIDE RANGE OF ACTIVES

Formulations with phospholipids are the perfect choice for the development of innovative dietary supplements.

Phospholipids – Nature’s Unique Molecules

Phospholipids, the main constituents of natural lecithin, are essential components of the human body and part of any cell membrane.

Due to their amphiphilic properties (hydrophilic head and lipophilic tail), phospholipids are multipurpose excipients for a wide range of applications. In water they can form a “shell” around a fat droplet which

allows the dispersion of oil in aqueous media. This is called an emulsion. In the absence of non-polar lipids and the presence of water, phospholipids organize as bilayer structures which are called liposomes. These structures are known from cellular membranes, where phospholipids naturally separate the cell from its environment (Fig. 1).

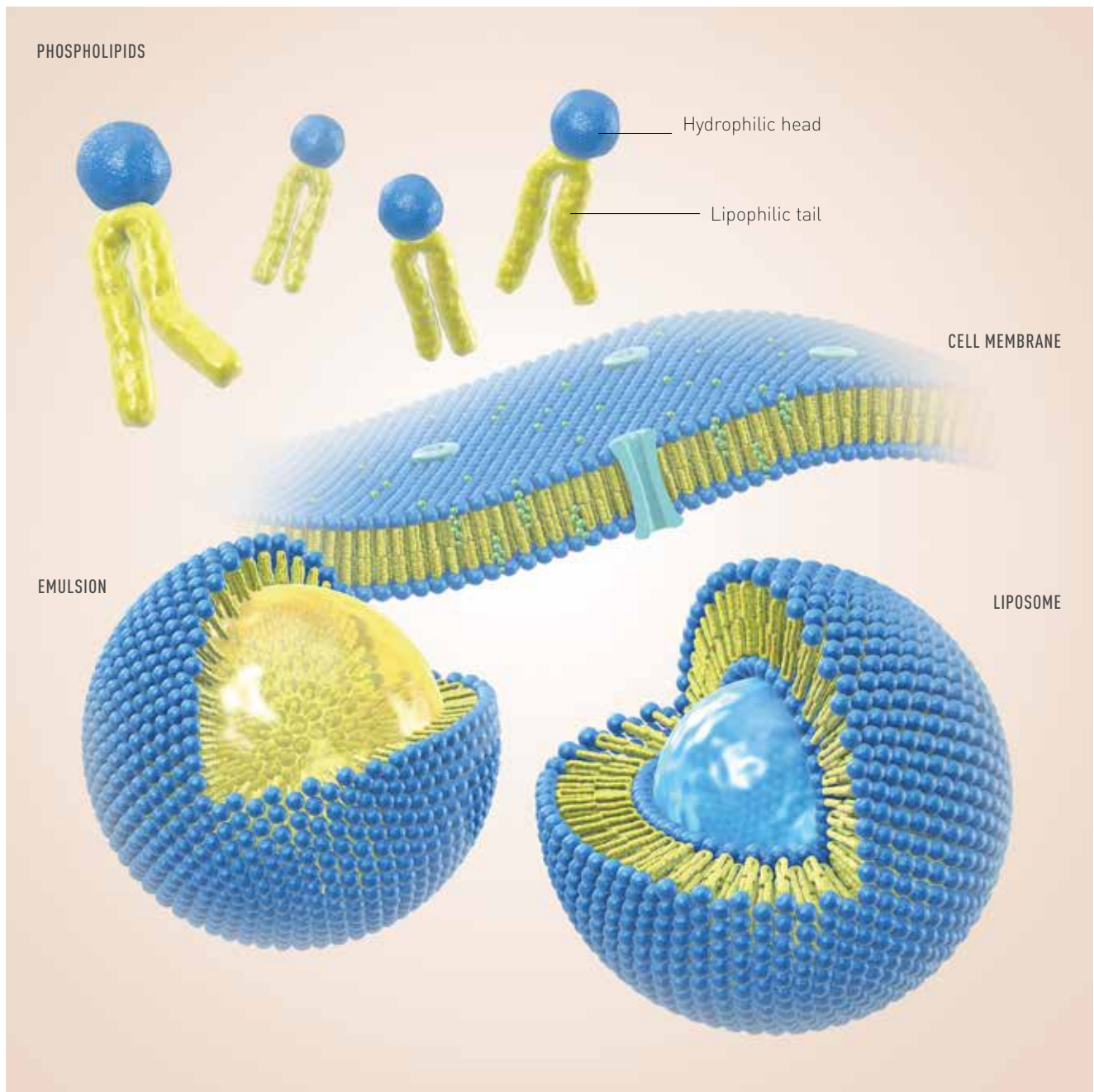


Fig. 1: Schematic depiction of phospholipids in an aqueous environment, an emulsion (phospholipid monolayer, encapsulation of lipophilic ingredients), and a liposome (phospholipid bilayer, encapsulation of hydrophilic ingredients).

Liposomal Formulations for Hydrophilic Actives

In liposomes, phospholipids organize as bilayer structures. The aqueous core of a liposome can be loaded with hydrophilic nutrients like vitamins, antioxidants, and plant extracts^[4].

For the preparation of liposomes, phospholipids are mixed with water and the desired active ingredients. Ethanol or glycerol may be added to improve the stability of the product or to enhance the solubility of

the ingredients. High-shear mixing is usually applied for the preparation of liposomes.

In a second step, ultrasound or high-pressure homogenization may be used to obtain smaller and homogeneously distributed liposomes. In general, a higher energy input usually results in a more homogeneous and stable product.

1. Liposome Formulation with Glutathione – based on LIPOID H 65

Phase	Ingredient	% w/w
A	Lipoid H 65	10
A	Ethanol	10
B	Glutathione	4.5
B	Deionized Water	65.5
C	Sodium Hydroxide	q.s.
D	Deionized Water	add to 100 %

Procedure

- Dissolve **LIPOID H 65** in ethanol
- Dissolve glutathione in water
- Adjust pH value to 6.0 with **C**
- Add **BC** to **A** while stirring
- Adjust pH value of **ABC** to 6.0 and add the missing amount of water
- Homogenize with a rotor-stator mixer while cooling

Technical Data

- Appearance: yellowish, milky liquid
- pH value: approx. 6.0
- Liposome size: around 300 - 400 nm

2. Liposome Formulation with Vitamin B Complex – based on LIPOID Liposome Basic

Phase	Ingredient	% w/w
A	Niacinamide (Vitamin B3)	0.32
A	Thiamine (Vitamin B1)	0.022
A	Pyridoxine HCl (Vitamin B6)	0.028
A	Cyanocobalamin (Vitamin B12)	0.00005
B	LIPOID Liposome Basic	add to 100 %

Procedure

- Dissolve components **A** in **B** at room temperature
- Vitamin B12 can be pre-dissolved in a minimal amount of water, if necessary

Technical Data

- Appearance: brown, clear, viscous liquid
- pH value: approx. 5.3
- Liposome size: around 30 - 50 nm

Dilution with Deionised Water

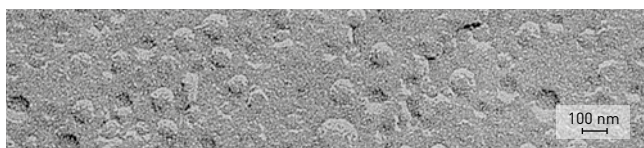


Fig. 2: Electron micrograph of LIPOID Liposome Basic.

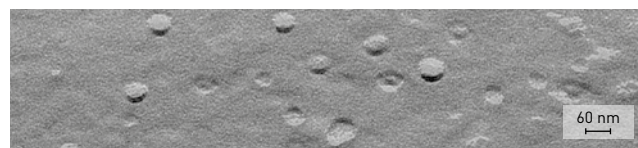


Fig. 3: Electron micrograph of diluted LIPOID Liposome Basic.

Emulsions for Lipophilic Actives

The oily core of emulsions is well suited for the solubilization and encapsulation of lipophilic nutrients and actives such as curcumin and the fat-soluble vitamins A, D, E, and K^[5].

For the preparation of emulsions, phospholipids are first mixed with water. Afterwards the oil phase

(up to 30 %) is added. To form a homogeneous emulsion, high-shear mixing is used as a first step.

In a second step, ultrasound or high-pressure homogenization is used to yield a homogeneous and stable product with a suitable droplet size distribution.

3. Emulsion with Vitamin D₃ – based on LIPOID P 45

Phase	Ingredient	% w/w
A	Vitamin D ₃	0.3
A	Medium-Chain Triglycerides (MCT)	4.5
B	Potassium Sorbate	0.1
B	Deionized Water	92.6
C	LIPOID P 45	2.5

Procedure

- Dissolve Vitamin D₃ in MCT
- Dissolve potassium sorbate in water
- Add **B** to **A** while stirring
- Add **C** to the mixture **AB**
- Homogenize with high pressure homogenizer

Technical Data

- Appearance: yellowish, milky liquid
- pH value: approx. 5.5
- Droplet size: around 200 - 250 nm

4. Emulsion with Cannabidiol (CBD)– based on PHOSAL® H 50

Phase	Ingredient	% w/w
A	PHOSAL® H 50	7.5
A	CBD Extract	3.5
B	Potassium Sorbate	0.1
B	Deionized Water	88.9
C	Citric Acid	q.s.

Procedure

- Dissolve CBD extract in PHOSAL® H 50
- Dissolve potassium sorbate in water
- Add **B** to **A** while stirring
- Adjust pH value with **C** to 5.5
- Homogenize with a rotor-stator mixer

Technical Data

- Appearance: yellowish, milky liquid
- pH value: approx. 5.5
- Droplet size: around 150- 200 nm

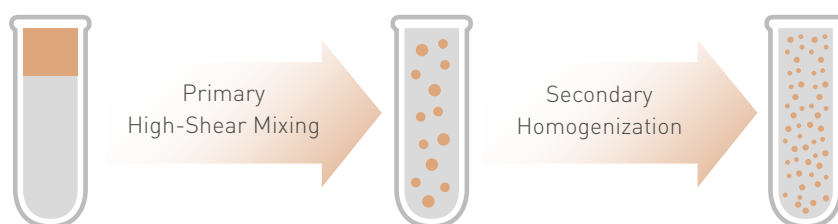
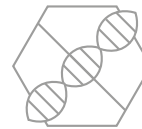


Fig. 4: Simplified process depiction for the production of emulsions.

Regulatory (Further regulatory data upon request)

All products

Safety	The product does not contain chemical additives.
Non-GMO	The product meets the non-GMO standards set by Regulation (EC) No. 1829/2003.
Manufacturing	The product is manufactured in Germany.



NON-GMO



NO HARMFUL
CHEMICALS



MADE IN
GERMANY

References (Additional references upon request)

- [1] van Hoogevest, P., Review—an update on the use of oral phospholipid excipients. *European Journal of Pharmaceutical Sciences*, 108, 1 – 12 (2017).
- [2] Chaves, M. A., Ferreira, L. S., *et al.*, Current applications of liposomes for the delivery of vitamins: a systematic review. *Nanomaterials*, 13(9), 1557 (2023).
- [3] Tarhan, O., Spotti, M. J., Nutraceutical delivery through nano-emulsions: General aspects, recent applications and patented inventions. *Colloids and Surfaces B: Biointerfaces*, 200, 111526 (2021).
- [4] Davis, J., Paris, H., *et al.*, Liposomal-encapsulated ascorbic acid: Influence on vitamin C bioavailability and capacity to protect against ischemia–reperfusion injury. *Nutrition and Metabolic Insights*, 9, 25 (2016).
- [5] Gebhardt, P., Van Hoogevest, P., *et al.*, A liquid phospholipid formulation of a curcumin extract with high concentration of phosphatidylcholine (PHOSAL® Curcumin) improves the transport of curcuminoids across Caco-2 intestinal epithelial cells, *Agro Food Industry Hi Tech* 30(4), 56 – 59 (2019).

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REUSAGE
OF WASTE

Representatives in many other countries.

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