DOOSAN

LECITHIN & PHOSPHATIDYLCHOLINE

Doosan Corporation

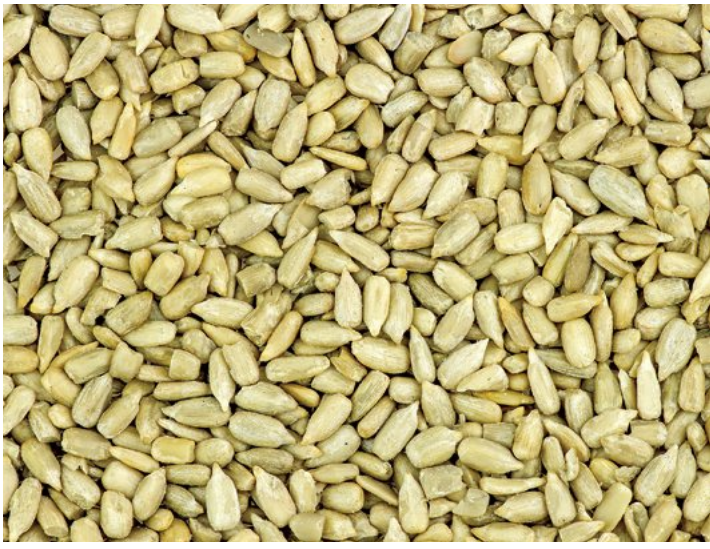
Doosan is Korea's oldest business organization with a proud history of 121 years

Doosan Corporation, Glonet BG

A leading global provider of functional lipids with more than 20 years of extensive experiences in offering the premier quality products

History

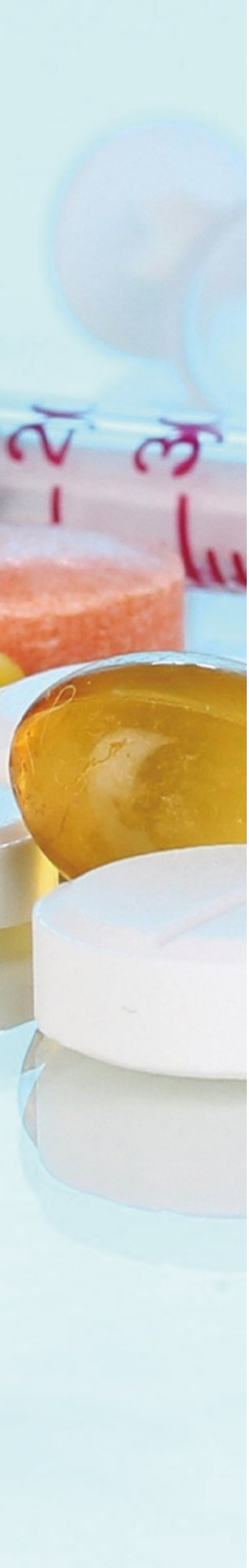
'60. Established corporate R&D center in Korea
'74. Began biotech research
'97. 1st production plant is constructed for pharma and nutraceutical egg phosphatidylcholine
'07. 2nd production plant is constructed for cosmeceutical sphingolipids
'10. Joint venture factory with Kelun pharmaceutical China is established for pharmaceutical egg phosphatidylcholine
'16. Extended the production pipeline to Soya phosphatidylcholine series for nutraceutical and cosmeceutical applications
'17. 3rd production plant is newly constructed specifically for Soya phosphatidylcholine series for pharmaceutical, food, cosmetic applications

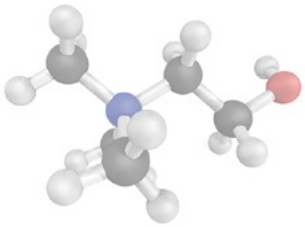


Lecithin & Phosphatidylcholine.

Lecithin is the generic term describing the mixture of phospholipids mainly consisting of phosphatidylcholine (PC) and other minor fractions including phosphatidylethanolamine (PE) and phosphatidylinositol (PI), and purified phospholipid is commonly called phosphatidylcholine.

Phosphatidylcholine is a vital component of the cell membrane in all living organisms and its water-like polar head and non-polar tail make it amphiphatic. Natural phosphatidylcholine can be obtained from animal (e.g. egg) and plant (e.g. soybean, sunflower, rape seed) origins, and owing to its particular chemical properties and biocompatibilities, phosphatidylcholine has been used as emulsifier, solubilizer, wetting agent and precursor of liposome for nutraceutical, cosmetic and pharmaceutical applications.





Pharmaceutical Use

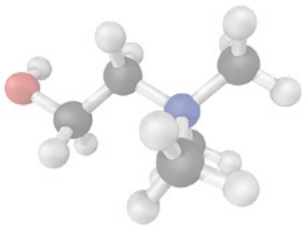
Clinical benefits of phosphatidylcholine include its effects on hepatic, neurologic, and cardiovascular diseases: Phosphatidylcholine reduces the alcohol-induced hepatic damages helping the regeneration of damaged cells and also has antioxidant properties protecting the body from aging; Phosphatidylcholine is considered as precursor of acetylcholine as well and research shows that its presence can affect the brain development and improve the long-term memory; Furthermore, phosphatidylcholine is shown to bring positive changes in hemodynamics of patients with circulatory instability.
In addition, phosphatidylcholine is used as an emulsifier and a carrier for the drug delivery system in pharmaceutical applications.

■ **Emulsifier & Drug Delivery for pharmaceutical applications**

- Stabilizer for oil and water emulsions
- Liposomal Delivery

■ **Active ingredients for pharmaceutical applications**

- Regeneration of damaged cell
- Antioxidations; Anti-aging
- Brain development; Memory improvement
- Hemodynamic balance



Food & Nutraceutical Use

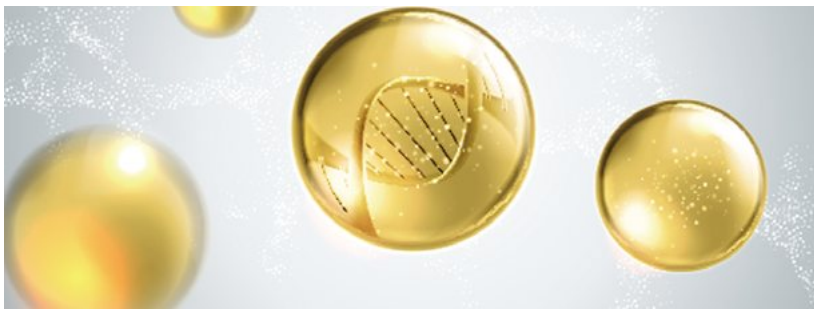
Phosphatidylcholine is used as an emulsifier and a functional additive for various applications of daily consumed foods and nutritional supplements. Natural phosphatidylcholine can be obtained from animal and plant origins without having it chemically modified and phosphatidylcholine from soybean also is classified as GRAS (Generally Regarded As Safe-FDA) making it safe and biocompatible with food applications.

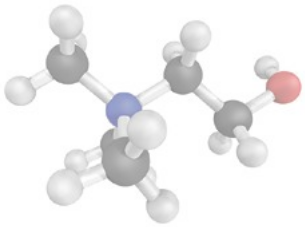
■ Emulsifier for food applications

- Bakery products
- Infant Foods
- Beverages
- Hard/Soft Capsules

■ Functional additives for nutritional supplements

- Aid of memory and learning
- Lowering the cholesterol value





Cosmetic

Phosphatidylcholine works as an emulsifier and wetting agent for topical emulsions. Furthermore, phosphatidylcholine serves as a precursor of liposomes in enhancing the penetration of encapsulated ingredients into the skin for the preparation of functional cosmetic products. Phosphatidylcholine is shown to be effective in skin regeneration, anti-aging, and acne prevention as well.

■ Emulsifier & Delivery Carrier for cosmetics

- Solubilizer for oil and water emulsions (O/W & W/O)
- Wetting agent

■ Ingredients for functional cosmetics

- Skin Care
- Hair Care

Soy

Phosphatidylcholine Product

Natural Ingredient

Doosan offers DS-Soya PC series comes in both GMO(PCR negative) and Non GMO grades and our high quality phosphatidylcholine products will ensure its compatibility and effectiveness as an emulsifier(stabilizer, solubilizer, wetting agents) and liposomal delivery carrier for various food and cosmetic applications.

■ Application

Product Name	PC	Food/Neutraceutical			Cosmetic			Pharmaceutical			
Soy PC	(%)	Emulsifier	Capsule	Tablets	Skin Care	Hair Care	Make-up	Oral	Topical	Parenteral	Pulmonal
Unsaturated PC											
DS-Soya PC50IP	45	•	•	•	•	•					
DS-Soya PC60	55	•	•	•	•	•					
DS-Soya PC60IP	55	•	•	•	•	•					
DS-Soya PC80	73				•	•		•	•		
DS-Soya PC94	94				•	•		•	•		
DS-Soya PC100	94							•	•	•	•
Hydrogenated PC											
DS-Soya HPC90	90	•			•	•	•	•	•	•	•

Hydrogenated PC

■ Specification

DS-Soya	PC50IP*	PC60/60IP*	PC80	PC94	PC100	HPC90
Appearance	waxy solid	waxy solid	waxy	waxy solid	waxy solid	powder
Phosphatidylcholine (PC), %	≥45.0	≥55.0	≥73	≥94.0	≥94.0	≥90.0
Lysophosphatidylcholine (LPC), %	≤5.0	≤5.0	≤7.0	≤6.0	≤3.0	≤4.0
Water, %	≤2.0	≤2.0	≤2.0	≤1.5	≤2.0	≤2.0
Ethanol, %	≤0.5	≤0.5	≤0.5	≤0.5	≤0.2	≤0.5
Peroxide value, mEQ/kg	≤10	≤10	≤5	≤5	≤3	≤3
Total aerobic count, cfu/g	≤100	≤100	≤100	≤100	≤100	≤100
Iodine value						≤1.0

* Non-GMO soy product
* Customized Soya PC product using non-GMO soybean available.

Sunflower

Phosphatidylcholine Product

Natural Ingredient

DS-SUN PC series come in two grade depending on the coutents of phosphatidylcholine originated from sunflower. While serving as an essential building block for cellular membrane, amphipathic nature of phosphatidylcholine allows it to be successfully used to improve emulsion stability. **Non-GMO and soy allergen free-Sunflower phosphatidylcholine can be applied for wide range of food and cosmetic application.**

■ Application

Product Name	PC	Food/Neutraceutical			Cosmetic			Pharmaceutical			
Sun PC	(%)	Emulsifier	Capsule	Tablets	Skin Care	Hair Care	Make-up	Oral	Topical	Parenteral	Pulmonal
DS-Sun PC50	48	•	•	•	•	•					
DS-Sun PC65	63	•	•	•	•	•					

■ Specification

DS-Sun	PC50	PC65
Appearance	Brownish waxy solid	Yellowish to brownish waxy solid
Phosphatidylcholine, %	≥48.0	≥63.0
Lysophosphatidylcholine, %	≤5.0	≤6.0
Moisture, %	≤1.5	≤1.5
Ethanol, %	≤0.5	≤0.3
Iodine Value	80~110	80~110
Peroxide Value, meq/kg	≤10	≤8
Acid Value, mg KOH/kg	≤30	≤30
Heavy Metals, ppm	≤10	≤10
Arsenic, ppm	≤2	≤2
Lead, ppm	≤0.2	≤0.2
Total aerobic count, cfu/g	≤100	≤100

Our Vision

Doosan Corporation-Glonet BG is the Bio-Industry leading company that values and pursues the health and beauty of human mankind inspired, and driven by professionalism and innovative technologies in research and development of functional materials.

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