Lecithins and Phospholipids

A Simple Guide to Use and Selection

ALC
AMERICAN LECITHIN COMPANY

About Lecithins

Lecithins are prepared by extracting and purifying phospholipids from naturally occurring products such as soybeans, eggs, and sunflower seeds. Lecithins are amphiphilic (they have different affinities for oil and water), and their low cost in use make them invaluable in a broad range of manufacturing processes.

The Unique, All-Natural Emulsifier

Lecithins help make chocolate smooth, improve the mouthfeel of beverages and help powdered baby formula dissolve easily in water. They help ink flow from ball-point pens, spray paints to provide even coatings and cooking sprays to keep food from sticking to hot surfaces. American Lecithin Company offers a wide range of standard, refined and fractionated lecithins. Sold under the ALCOLEC® brand name, they are available in liquid, granular and powder form.

Chemical characteristics, product attributes, classifications and labeling criteria in this brochure refer to American Lecithin soy-based products unless where specifically noted. To learn about American Lecithin products derived from other sources, contact us at 203.262.7100.

How Lecithins Work

Lecithins are used mainly as emulsifiers. They are surface-active; simultaneous hydrophilic (water-loving) and hydrophobic (water-repelling) properties enable lecithins to make stable blends of materials that otherwise do not mix easily and tend to separate. The amount of lecithin needed to blend substances such as the soybean oil and water in margarine, or the pigment in latex paint, depends on the overall fat content in the end product.

Lecithins also have characteristics that help:

- Disperse and suspend powders into liquids
- Control the viscosity of liquids and semi-liquids
- Prevent foods from sticking to contact surfaces
- Prevent adhesion of food products to one another

Lecithins can be:

Emulsifiers

Emulsions are produced by dispersing normally unmixable material into another by mixing, colloidal milling or homogenization. The surface-active qualities of lecithins make them effective emulsifying agents that reduce mixing time and maintain the stability of the dispersion.

Wetting and Instantizing Agents

Lecithins provide fast, complete wetting of powders into aqueous systems. Low-fat powders require lecithins with lower HLB values (see explanation on page 8 or refer to our Instantizing brochure) to retard wetting rates; fatty powders require higher HLB values.

Viscosity Modifiers

Lecithins greatly reduce the surface tension of fats, enabling particles of chocolate, sugar and milk products, for example, to be coated, improving flow and mixability. Typical usage levels are 0.2 – 0.6% of total product weight.

Release Agents

Lecithins promote separation of food from contact surfaces in dip tanks and spray applications. Water-filled dip tanks usually contain up to 10% de-oiled lecithin; pan or belt-release applications consist mainly of vegetable oil with approximately 2% lecithin.

Separating Agents

When applied directly to products such as processed cheese slices, lecithins help form a stable film barrier that prevents them from sticking together. When used directly in products such as baked goods, they enhance the ability to cut and shape products and reduce sticking to mixing vessels.

Extrusion Aids

Extrusion technology uses lecithin as a processing aid to enhance extrusion rates and throughput, resulting in more economical production. Examples of extruded products include snack foods, pasta, sprinkles and pet treats.

Anti-Dusting Agents

Inclusion of ALCOLEC® lecithins enhances wettability by reducing static interface.

Shelf-Life Aids

Incorporation of ALCOLEC lecithin with the amylose portion of wheat flour slows starch retrogradation. This process in effect extends shelf life.

Nutritional Supplements

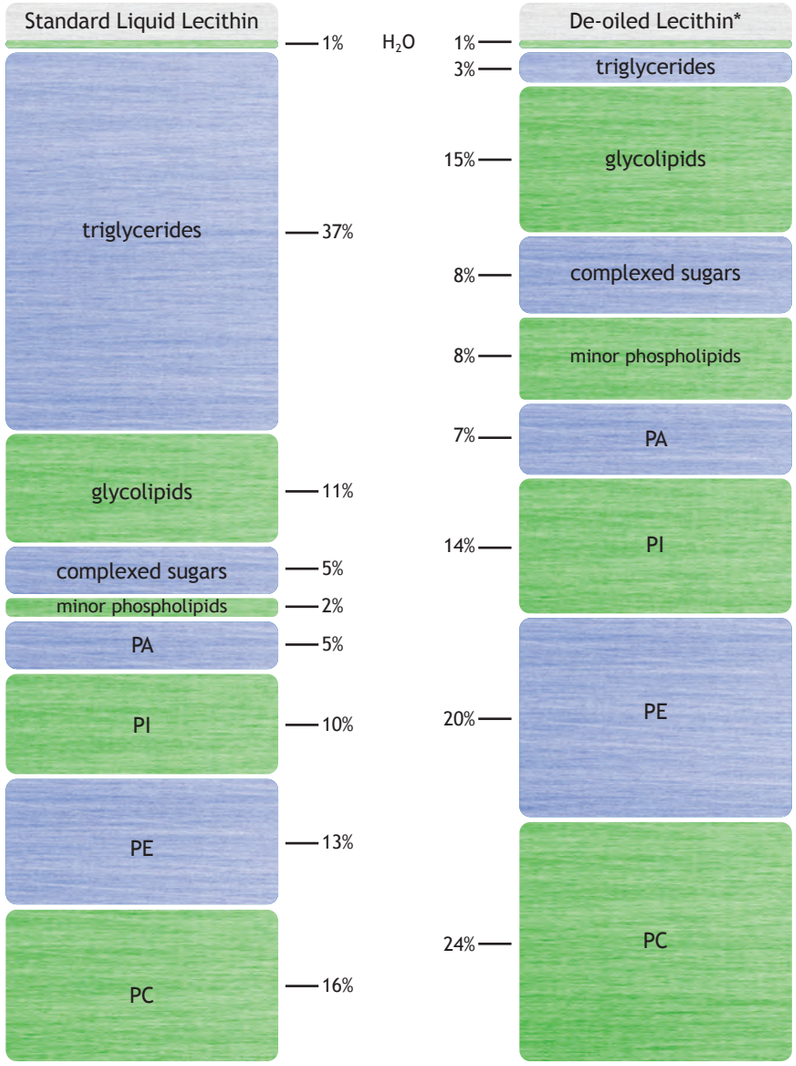
Lecithins have nutritional value of their own. The phospholipids they contain, such as phosphatidylcholine (PC), phosphatidylserine (PS) and derivatives such as glycerophosphocholine (alpha-GPC) have been widely acknowledged by nutritionists, and substantiated by numerous human clinical studies, as beneficial to the function of the liver, brain, heart, and other organs. American Lecithin Company offers these specialty phospholipid fractionations through the LIPOID® brand of nutritional ingredients. The LIPOID products are available in various formulations, developed specifically for use in softgels, tablets, hardcap and powdered (RTD) nutritional supplements. For more information, refer to the “Phospholipids for Nutrition” brochure or visit www.americanlecithin.us

Chemistry

Most of the performance benefits of lecithins come from the unique hydrophilic and hydrophobic surface-active properties of phospholipids, their primary components.

Common ranges of phospholipids present in liquid soybean lecithin:

- Phosphatidylcholine (PC, 14–16%)
- Phosphatidylethanolamine (PE, 10–15%)
- Phosphatidylinositol (PI, 10–15%)
- Phosphatidic acid (PA, 5–12%)



*Granular or powdered form; most triglycerides and free fatty acids are removed.

Typical Composition

Customizing Lecithins

Formulated

By adding other ingredients such as refined oils or surfactants, formulations for specific applications can be developed.

De-oiled

De-oiling is a process which removes the majority of the secondary components of lecithin including triglycerides, sterols, free fatty acids and carbohydrates. This serves to enhance the relative composition of the phospholipids.

Fractionated

Fractionating lecithins enriches individual phospholipid components. Very delicate applications require the purest lecithin which contains more than 80% phosphatidylcholine.

Emulsification

- Fluid lecithins tend to disperse more easily in oil
- De-oiled (powdered) lecithins disperse more easily in water
- Heating to 120°F (50°C) helps dispersion and can improve handling and mixing characteristics
- Oil-in-water emulsions typically include lecithin at 5-10%, and water-in-oil emulsions at 1-5% of the oil's weight
- Salt levels higher than 1-2% may affect lecithin functionality

Particle size affects lecithin requirements in wetting and instantizing applications. Larger particles have less surface area and may require as little as 0.25% w/w lecithin addition; while smaller particles with larger total surface area can require up to 2%.

Lecithin can be derived from various sources. Though soybean-derived lecithins have historically been the industry standard, American Lecithin has developed products from alternate sources such as egg yolk and sunflower for nutritional, functional or labeling purposes. These lecithins have distinct phospholipids and fatty acid composition that allow for an array of new applications.

Technical Parameters

Lecithin products are classified using attributes such as color, viscosity, and the percentages of certain components. The terms used when specifying lecithins are:

Phosphatidylcholine (PC)
Amphiphilic molecule and main emulsifier in lecithin. PC is the major component of biological membranes and supplements the diet with natural choline.

Acetone Insolubles (AI)
Expressed as a percentage. This is a measure of the surface-active portion of a lecithin, comprised mainly of phospholipids and glycolipids.

Acid Value (AV)
Expressed as meq KOH/kg. This is a measure of total acidity afforded by ionizable groups of phospholipids and free fatty acids added to some liquid lecithins to stabilize viscosity.

Color
Measured against the Gardner scale. Most lecithin products range from having a light honey (11 on the scale) to dark amber (17 on the scale) color.

Hexane Insolubles (HI)
Expressed as a percentage (usually under 0.1%). Measures residual non-fatty material, composed mainly of soybean meal fines.

Moisture (H_2O)
Measured by the Karl Fisher method, a potentiometric titration specific for water. Powder and liquid lecithins typically contain approximately 1% water.

Viscosity
Reported in centipoise (cP) at 25°C/77°F, after evaluation with a Brookfield rotary viscometer.

Peroxide Value (PV)
The peroxide value is a measure indicative of a product's degradation. Lecithin and phospholipids have naturally occurring unsaturated fatty acids which contribute to their nutritional benefits. In the absence of gentle processing and storage conditions the unsaturated double bonds that are present can undergo an auto-oxidation process which in turn creates free radicals. Modern day diets are intentionally fortified to fight free radicals in the body which can change DNA, cause inflammation and stress to cells, etc. American Lecithin Company specifies the lowest possible peroxide values possible.

HLB Value
Emulsification properties of different lecithins are a function of their water-or fat-loving qualities, known in the industry as Hydrophilic-Lipophilic Balance or HLB.

Technical Parameters
Continued

Product	Physical State	Typical PC	AI min	AV max	Color max	HI max	Moisture max	Viscosity cP max	PV max	HLB
ALCOLEC® Standard Fluid Grade										
S	Fluid	14%	62%	32%	17	0.10%	1.00%	12,000	10%	4
BS	Fluid	14%	62%	32%	14	0.10%	1.00%	12,000	100%	4
XTRA-A	Fluid	14%	66%	25%	17	0.10%	0.80%	15,000	10%	2
HL	Fluid	14%	60%	35%	12	0.30%	1.00%	12,000**	10%	4
ALCOLEC® De-oiled										
Granules	Granular	24%	97%	36%	tan	0.02%	1.00%	N/A	4%	7
F-100	Powder	24%	97%	36%	tan	0.02%	1.00%	N/A	4%	7
FF-100	Fine Powder	24%	97%	36%	tan	0.02%	1.00%	N/A	4%	7
H 20	Fine Powder	20%*	97%	35%	tan		2.00%	N/A	5%	7
ALCOLEC® Encapsulation Grade										
SGU (unbleached)	Fluid	14%	60%	36%	17	0.02%	0.80%	6,000	10%	4
ALCOLEC® Heat Resistant										
HR	Fluid		53%	25%	14	0.02%	0.50%	3,000	100%	7
DHR	Powder		97%	36%	tan	0.30%	1.50%	N/A	10%	8
ALCOLEC® Easily Sprayable										
Aquasperse A	Fluid	10%	47%	21%	14	0.02%	0.80%	2,500	N/A	12
LV-30	Fluid	11%	50%	26%	14	0.01%	0.80%	1,500	100%	4
PC Enriched										
ALCOLEC® 40P PCR Neg.	Powder	40%*	97%	28%	tan	N/A	1.20%	N/A	3%	8
Phosal Series	Fluid	34-72%*	55%	35%	16	0.30%	1.50%	7,000	10%	7
	Fluid	50%*	97%	N/A	yellowish	N/A	1.50%	N/A	10%	8
	Fluid	70%*	97%	N/A	yellowish	N/A	1.50%	N/A	10%	9
Enzyme-Modified										
ALCOLEC® LEM	Fluid	14%	56%	40%	17	0.30%	0.40%	10,000		8
ALCOLEC® EM	Powder	24%	97%	36%	tan	0.30%	1.50%	N/A	10%	9
LIPOID® P LPC 80	Agglomerate	80%†	97%		tan		2.00%	N/A	10%	

† - Minimum LPC Content
* - Minimum Analyzed Value
** - ALCOLEC® HL Viscosity Reported in mPAS

Labeling Lecithins

ALCOLEC® lecithins are all-natural and certified as generally safe for use in food under various compliance standards worldwide. The inherent nutritional value in soy, egg and sunflower lecithins and their association with good health add value when source-labeling products.

In the U.S., most ALCOLEC lecithins are Generally Recognized as Safe (GRAS) by the Food and Drug Administration as a multiple purpose food ingredient under the Code of Federal Regulations (21CFR Sec 582.1400) and specifications of the Food Chemicals Codex.

In the European Union, most American Lecithin products conform to EC-Directive 96/77 EC Lecithin (No. E322). Most are also approved by the World Health Organization as a food additive under Codex Alimentarius Standard INS 322.

Chemically modified lecithins sometimes require special labeling. When enzymatically modified, for example, labels read Enzymatically Modified Soy Lecithin.

ALCOLEC® lecithins are Kosher and HALAL approved

Source of Origin

American Lecithin Company offers conventional, PCR Negative and Identity Preserved options depending on your sourcing and labeling requirements.

Conventional: conventional soybeans are not grown in accordance with identity preserved protocols.

PCR Negative: Not grown against identity preserved protocols. However, finished product is analyzed at an independent third party lab for the presence of genetically modified DNA using the PCR (Polymerase-Chain-Reaction) Roundup Ready method. Negative results denote PCR Negative Status.

IP (Identity Preserved): Material that is produced without utilizing Bio-engineered soybeans. Validated documentation plans at each level of farming and manufacturing are used to ensure the products identity preservation. Third party certification of conformance of IP procedures is utilized and finished product testing guarantees a maximum of 0.9% residual GM DNA.

Labeling Lecithins
Continued

This chart shows typical nutritional information associated with various sources of lecithin.

Nutritional Summary (per 100 grams product)	Liquid		Granular		
	Soy ALCOLEC® S	Sunflower ALCOLEC® HL	Soy ALCOLEC® F100	Sunflower ALCOLEC® H-20	Egg ALCOLEC® E-25
Calories	790	790	700	700	463
Calories From Fat	650	595	480	480	225
Total Fat (g.)	69	66	53	53	25
Saturated Fat (g.)	14	10	12	6	12
Approximate Fatty Acid Composition (in percent of total fatty acids)					
Monounsaturated	12	17	10	11	27
(oleic, 18:1)	12	17	10	11	27
(erucic, 22:1)	<1	<1	<1	-	<1
Polyunsaturated	61	60	66	63	23
(linoleic, 18:2)	55	60	60	62	17
(linolenic, 18:3)	6	-	6	<1	-
(arachidonic, 20:4)	-	-	-	-	4
(docosahexaenoic, 22:6)	-	-	-	-	2
Saturated	21	19	24	23	47
(palmitic, 16:0)	17	13	20	17	33
(stearic, 18:0)	4	5	4	5	14
(arachidic, 20:0)	-	1	-	<1	-
Trans Fatty Acid	<0.5	<0.5	<0.5	<0.5	<0.5
Primary Acetone Insolubles (per 100 grams product)					
Phosphatidylcholine (g.)	16	15	24	25	19
Phosphatidylethanolamine (g.)	13	7	20	9	5
Phosphatidylinositol (g.)	10	10	14	20	-

Please inquire about nutritional profiles for specific products.

Selection

The chart on these pages and pages 14-15 can help you determine which products are best suited for your applications.

Product		Adds Lubricity	Crumb Softener	Dough Conditioner	Mixing/ Blending Aid	Surface Coating	O/W Emulsifier	W/O Emulsifier	Release Agent	Viscosity Modifier	Wetting Agent	Anti-Staling	Softgels	2 piece Hard Caps	Tablets
ALCOLEC® Standard Fluid Grade															
Stable, unrefined fluid blends of soybean oil and phospholipids.	S				•			•	•	•					
	BS				•			•	•	•					
	XTRA-A				•			•		•					
	HL				•			•	•	•					
ALCOLEC® Standard De-oiled Grade															
Oil-free powders or granules for enhanced water dispersibility and easier handling.	Granules	•	•	•	•		•		•	•	•				•
	F-100	•	•	•	•		•		•	•	•				•
	FF-100	•	•	•	•		•		•	•	•				•
	H-20	•	•	•	•		•		•	•	•				•
ALCOLEC® Encapsulation Grade															
Developed for soft gelatin capsulation requiring clarity and brilliance.	SGU (unbleached)							•					•		
ALCOLEC® Heat Resistant															
Maintain a light yellow color when exposed to high temperatures.	HR					•		•	•						
	DHR					•		•	•						
ALCOLEC® Easily Sprayable															
Modified and processed low-viscosity fluids that can serve as dispersants, wetting agents, emulsifiers, release agents and stabilizers.	Aquasperse A				•		•		•	•	•				
	LV-30							•	•	•	•				
PC Enriched															
Modified to provide higher levels of choline, widely recognized as a contributor to good health.	ALCOLEC® 40P PCR Neg.						•							•	•
	Phosal® Series												•		
Enzyme-Modified															
Especially useful in food as an instantizer and to help maintain freshness.	ALCOLEC® EM						•					•	•		
	ALCOLEC® LEM						•					•	•		
	LIPOID® P LPC 80						•				•	•			

Use levels depend on the application and usually fall within the range of 0.2-0.5% of finished product weight. We recommend starting with 0.5% of finished product weight initially and adjust as necessary.

A Guide to Applications

Application	Suggested Products	Usage Instructions & Effect
Baked Goods		
Bread and other yeast-raised products	ALCOLEC® EM	0.5-1% based on flour in breads. Shelf life, dough conditioning.
Cake	ALCOLEC® F100, ALCOLEC® H 20	Dry, blendable emulsifier for cake mixes. Also improves symmetry, grain, texture.
Cookies	ALCOLEC® F100, ALCOLEC® H 20	1-3% based on flour. Improves creaming. Also release benefits in high sugar batter-type products.
Low fat cookies, crackers, pretzels	ALCOLEC® F100, ALCOLEC® H 20	1% based on flour. For machinability. Improves sheeting, dough lubricity, reduces downtime, better dough extrudability.
Pizza crust	ALCOLEC® F100, ALCOLEC® H 20	0.5-1% based on flour. Controls shrinkage, improves dough handling release.
Waffles, pancakes	ALCOLEC® F100, ALCOLEC® H 20	Improves tenderness in no/low fat products. Reduces batter viscosity.
Caramel Corn	ALCOLEC® LV-30, ALCOLEC® F100, ALCOLEC® H 20	ALCOLEC F100 at 0.5-1.0% can be added to the sugar syrup and 5-15% of ALCOLEC LV-30 can be added to the vegetable oil.
Cheese Release	ALCOLEC® LV-30	Spray on surface to promote easy slice separation in low- and high-moisture cheese products.
Cheese Sauces	ALCOLEC® F100, ALCOLEC® H 20	Add into oil at 3-5% based on total fat for smoothness and consistency.
Chewing Gum	ALCOLEC® F100, ALCOLEC® H 20	0.7-3% in the gum base. Enhances product softness and smoothness; reduces tackiness, controls adhesion.
Chocolate	ALCOLEC® F100, ALCOLEC® H 20	Use at 0.2-5% level. Reduces viscosity; reduces fat requirement.
Cocoa	ALCOLEC® F100, ALCOLEC® H 20	Wetting agents for cocoa powders.
Colors	ALCOLEC® F100, ALCOLEC® H 20	Oil soluble colors made water dispersible.
Cottage Cheese	ALCOLEC® F100, ALCOLEC® H 20	Enhances curd formation to improve production yields.
Flavors	ALCOLEC® F100, ALCOLEC® H 20	Oleoresins made water dispersible.
Frostings	ALCOLEC® F100, ALCOLEC® H 20	Acts in combination with polysorbate to provide excellent emulsification and air entrapment. Use at 2-4% based on the fat.
Griddle/Wok Oils	ALCOLEC® LV-30	0.15-0.5% for release.
Granola Bars	ALCOLEC® F100, ALCOLEC® H 20	Blendable powder; low flavor binding material; high quality dietary fat source.

Use levels are usually 0.2% based on finished product weight.
If no specific information is available, start with 0.5% of finished product and adjust as necessary.

A Guide to Applications
Continued

Application	Suggested Products	Usage instructions & effect
Ice Cream Cones	ALCOLEC® F100, ALCOLEC® H 20	0.5-1% based on flour. Mold release, viscosity control, emulsification.
Infant Formula	ALCOLEC® EM, LIPOID® E 80, E 25, E 80 O, E 20 O	Effective oil-in-water emulsifier for a wide variety of oils. Use at 3-5% of fat level.
Instantizing	ALCOLEC® LV-30 ALCOLEC® F100, ALCOLEC® H 20	Control hydration rate of hydrophilic powders. Use at 0.5-1.0%. Promote hydration of fatty/hydrophobic powders.
Margarine	ALCOLEC® Xtra A	Enhanced water-in-oil emulsifier. Use at 0.2-0.5% to prevent spattering.
Meat Sauces, Gravies, Canned Meat Products like Chili	ALCOLEC® F100, ALCOLEC® H 20	Dry, easy to use powder; blends in quickly at 0.25-0.5%; helps control unsightly at separation. Also lowers fat crystallization temperature to benefit sauce pumpability.
Milk Powders	ALCOLEC® F100, ALCOLEC® H 20	Excellent wetting of whole milk powders. Use at 0.5-1.0%.
Non-Dairy Creamers	ALCOLEC® F100, ALCOLEC® H 20	Acts as an emulsifier to replace mono and diglycerides. Use level 3-5% based on total fat.
Release		
Oil based	ALCOLEC® LV-30	Use at 5-15% level. Good solubility in pump and aerosol-type formulations.
Water based	ALCOLEC® F100, ALCOLEC® H 20	Effective oil-in-water emulsifier for a wide variety of oils. Use at 25-30% of oil/fat level.
Belt release	ALCOLEC® Aquasperse A	Water dispersible for use as a belt release in continuous cooking operations. Use at 10-15% level in water.
Heat resistant	ALCOLEC® HR, ALCOLEC® DHR	For use at high temperature applications at 1% finished product.

Use levels are usually 0.2% based on finished product weight.
If no specific information is available, start with 0.5% of finished product and adjust as necessary.

About American Lecithin Company

American Lecithin is a member of the Lipoid Group of companies. Lipoid is the global leader in the manufacture of the widest range of lecithins and phospholipids for the food, nutritional, pharmaceutical and cosmetic industries.

American Lecithin's ALCOLEC® products are used in food processing and a wide range of nutritional and industrial applications. For more than 90 years, American Lecithin has continually improved the basic properties of its lecithins, creating new products with better performance in a broad range of uses. We remain committed to providing the very best in quality, consistency and technical support for our full range of products, from standard grade lecithins to purified phospholipid fractions.

American Lecithin

ALC
AMERICAN LECITHIN COMPANY

American Lecithin Company
115 Hurley Road, Unit 2B
Oxford, CT 06478

Phone: 203.262.7100
Fax: 203.262.7101
Toll-Free: 1.800.364.4416

americanlecithin.us
info@americanlecithin.us

For information about lecithins used in pharmaceuticals and personal care products, visit www.lipoid.com.