



K-FLEX[®] Plasticizers and Coalescents:

- High Performing
- Fast Fusing
- Broadly Compatible
- Non-Phthalate
- Low-VOC

EMERALD KALAMA CHEMICAL

KFLEX[®]

Plasticizers & Coalescents

Emerald Kalama Chemical

General Uses

K-FLEX® plasticizers, modifiers and coalescents are known for their **excellent value and balance of performance properties**. They are non-phthalate, low in VOCs, and have positive attributes from a product safety and health perspective compared to other choices.

The K-FLEX product line continues to grow as we invest in **developing new offerings and expanding into new applications to meet the evolving needs of the industries we serve**. Our team is engaged – participating in key industry associations, delivering presentations on our latest technical developments and seeking out creative new ways to bring value-added solutions to our customers.

One of the key properties of K-FLEX products is their **compatibility with a wide range of polymers**, particularly polar materials. This makes K-FLEX products highly effective in many of the most widely used non-olefin based polymers: PVC, polyvinyl-acetate, polyvinyl-acetate/ethylene copolymers, acrylic, styrenated acrylic, styrene-butadiene, polysulphide, nitrocellulose, nitrile, and polyurethane. These polymers are also widely used in many end-use applications, including adhesives, sealants, caulks, paint, coatings, graphic arts, resilient flooring, vinyl wall covering and artificial leather.

K-FLEX for Adhesives

For decades, our adhesives customers have turned to dibenzoate plasticizers because they offer the best overall performance, providing excellent **viscosity response, reduced set times, increased open times, increased film flexibility and clarity, reduced heat sealing temperatures, and improved water resistance**. These properties are valued in mastics and caulking compounds, sealants, and adhesive applications used in the packaging industry for carton sealing and forming, book binding, labeling, furniture, luggage and shoes. Specific 21 CFR listings for use in adhesives and coatings with direct contact to food (as indirect food additives) are shown in the product selection guide in this brochure.

K-FLEX for Coatings

In recent years, more customers have come to appreciate the value that ultra-low-VOC benzoate coalescents can bring as they work to meet lower and lower VOC industry requirements or seek an alternative to phthalates. New technologies deliver **performance benefits to coatings that extend beyond the reduction of VOCs**: improving scrub resistance and gloss while maintaining important features such as good blocking resistance and low dirt pick-up. This balance of performance features may be surprising to many formulators, who expect plasticizers—which are more persistent in the film than traditional volatile coalescents—to have unsatisfactory performance in these areas. The newest generation K-FLEX products provide very effective performance in coatings.

K-FLEX for Vinyl

Our latest developments in plasticizers for vinyl applications provide outstanding performance features. These **very high solvators for PVC are fast fusing and will increase processing speed and lower processing temperatures**. K-FLEX plasticizers also provide superior wear performance, increased stain resistance and resistance to extraction by solvents such as kerosene, cotton seed oil and other non-polar materials. These properties make K-FLEX an excellent choice for the production of vinyl flooring, artificial leather (cloth), wallpaper, extrusions, calendaring and plastisols. Blends of K-FLEX plasticizers with general purpose-type plasticizers – or with other specialty plasticizers such as adipates and citrates – are often used to take advantage of the exceptional properties of the K-FLEX plasticizers. Non-phthalate general purpose plasticizer performances can be greatly enhanced with the addition of K-FLEX, reducing or eliminating issues arising from poor compatibility, such as exudation or slow manufacturing speeds.

Please contact us. Our K-FLEX team welcomes the opportunity to work with you.

K-FLEX® Plasticizers...
Keeping an eye on your future.

Emerald Kalama Chemical is a world-scale producer of a variety of toluene oxidation products including benzoic acid and various benzoate and dibenzoate esters, alcohol and aldehyde derivatives for food preservatives, aroma chemicals, plasticizers, and a range of industrial applications.



Products Available

K-FLEX® DP – Dipropylene glycol dibenzoate is one of the most versatile polar, high solvating plasticizers. It is compatible with a wide range of polar polymers and rubbers, including TPU. It is an excellent choice for high solvating plasticizer applications.

K-FLEX® PG – Propylene glycol dibenzoate is designed primarily for use in PVC compositions. It imparts outstanding stain resistance and durability in vinyl applications and can be used in adhesives to achieve higher percent solids.

K-FLEX® 500 – A classic dibenzoate blend. As a polar plasticizer, it is a high solvator for PVC and compatible with polar polymers such as polyvinyl acetate. It is primarily used in adhesive applications.

K-FLEX® 500P – A dibenzoate blend designed for coatings or other applications where ultra low levels of VOCs are desired.

K-FLEX® 850P – A dibenzoate blend designed for vinyl applications with economy as a focus. It offers excellent stain resistance, durability and can be used alone or in blends with other plasticizers.

K-FLEX® 850S – A low VOC blend of dibenzoates optimized for use in waterborne latex applications. Widely used in the industry because of the excellent combination of efficiency, economy and performance benefits it provides to the formulator. In Europe K-FLEX® 850S is label-free.

K-FLEX® 975P – A dibenzoate triblend compatible with polar polymers. It offers a lower freeze point and better handling properties than other modern binary dibenzoate blends.



We are strategically located near shipping ports and railways to ensure economical and fast delivery of products to our customers.

K-FLEX® Plasticizers

Application Chart

Application	Uses	K-FLEX® 850S	K-FLEX® 850P	K-FLEX® 500	K-FLEX® 500P	K-FLEX® 975P	K-FLEX® PG	K-FLEX® DP
Adhesives & Sealants	Hot-melt Adhesives		○	○		●		
	Latex Adhesives	●		○		●		○
	Putty	○				●		○
	Plastisol/Vinyl Sealants		●			●		○
	Latex Caulks & Sealants		●			●		○
	Polysulphide Sealants	○	●					○
	Silane Modified Polymer Sealants			●		●		
Paints & Coatings	Interior Latex Paint	●		○	●	●		
	Exterior Latex Paint	●		○	●	●		
	Industrial Coatings	●		○	●	●		
	Special Purpose Coatings	●		○	●	●		
	Lacquers - Nitrocellulosic & Acrylic	○		●	●			●
	Dispersions		○			○		
Paper	Paper Coatings	●				○		
Vinyl Applications	Plastisol Flooring		●	○		●	○	
	PVC Melt Compounding		●			●	○	
	Plastisol Consumer Products		○			●	○	
	Plastisol Printing		○				○	●
Personal Care	Nail Care						○	●
	Depilatory Wax		○					●
Graphic Arts & Printing	Flexographic Ink	●				○		
Agriculture	Pesticide Carrier							●
Industrial Intermediates	Equipment Clean Out & Purge		●					

● Highly Recommended ○ Effective

K-FLEX® Plasticizers add value to a wide range of applications and are compatible in many polymers.

Typical Physical Properties

Property	K-FLEX® 850S	K-FLEX® 850P	K-FLEX® 500	K-FLEX® 500P	K-FLEX® 975P*	K-FLEX® PG	K-FLEX® DP
Boiling Point (5 mm Hg, °C)	180	180	191	236	215	157	195
Boiling Point (750 mm Hg, °C, extrapolated)	>330	>330	>350	>350	>350	>300	>350
Density, ASTM D1475, 25°C, g/ml	1.14	1.14	1.14	1.15	1.15	1.14	1.11
Density, ASTM D1475, 25°C, lbs/gal	9.6	9.6	9.5	9.6	9.6	9.5	9.3
Freeze Point, °C	14	12	6	6	4	-50**	-51**
Moisture Content, %	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Viscosity, Brookfield RVT, 20 RPMs at 250C, cps and mPa·s	72	76	80	107	73	81	99
Viscosity, Kinematic, 25°C, cSt	63	66	70	93	63	71	89
VOC%, ASTM D2369	2.2	1.7	2.9	0.9	2	5.8	3.2
FDA Listing¹							
21 CFR 175.105	Yes	Yes	Yes	Yes	Yes	Yes	Yes
21 CFR 176.170	Yes	Yes	Yes	Yes	No*	No	Yes
22 CFR 176.180	Yes	Yes	Yes	Yes	No*	No	Yes

* K-FLEX 975P may be used as a plasticizer at a level not to exceed 20% in an adhesive under 21 CFR 176.170 and 21 CFR 176.180, provided the adhesive is separated from the food by a functional barrier, or is limited to contact with food so as not to exceed trace amounts at seams and edges.

** Glass Point by DSC

¹ Emerald Performance Materials does not warrant that these product(s) are suitable under applicable food additive / food contact regulations of any potential use. The responsibility for determining the overall compliance with applicable food additive / food contact laws and regulations is with the company manufacturing the final consumer product and/or the person placing the products described herein in contact with food. This information is provided in good faith and is believed accurate as of the date of this letter. No warranty is subsequently expressed or implied. Liability is expressly disclaimed.

Plasticizer/Polymer Compatibility¹

Plasticizer	Solubility Parameter (cal/cm ³)	Resin Compatibility %																	
		PVC	PVAC	PVButyral (% PVOH Content)		Cellulose Nitrate	Cellulose Acetyl (Acetyl Content)		CAP	CAB (% Butyryl Content)		EC	PS	PU	PC	PMMA	SBR	Chlorinated Rubber	
				13%	21%		Lo	Hi		17%	37%							CR	N
Diethylene Glycol Dibenzoate (DEGDB) ²	10.1	100	100	100	33	100	10	10	100	100	100	100	0		50	100			
Dipropylene Glycol Dibenzoate (DPGDB) ³	9.6	100	100	100	100	100	10	10		25	100	100	33	100	33	100	100 ⁴	100	100
Acetyl Tri-n-butyl Citrate (ATBC)	9.0	100	100	50	50	100	30	50										100	100
Butyl Benzyl Phthalate (BBP)	9.9	100	100	100	50	100	10	10	80	100	100	100	100	25	60	100	50	80	30
Di-2-Ethylhexyl Adipate (DEHA)	8.5	75	0	25	25	35	0	0	10	25	25	100	100	15	10	15	50	100	30
Di-2-Ethylhexyl Phthalate (DEHP)	8.2	100	5	>15	>15	100	0	0	20	50	50	100	100	25	25	100	50	100	30

¹ Source: [The Technology of Plasticizers](#), Sears and Darby, John Wiley & Sons.

² Component of K-FLEX 850S and K-FLEX 500.

³ Component of K-FLEX 850S, K-FLEX 500 and K-FLEX DP.

⁴ Value for DEGDB and DPGDB blend. No values were provided for the individual dibenzoates.



Regulatory Listing

FDA CFR Listings*

The main components of **K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 975P*, K-FLEX® 500P, K-FLEX® PG, K-FLEX® DP Plasticizers** can be safely used as plasticizers in food packaging adhesives; in paper and paper coatings in contact with dry foods; and/or, in certain instances in paper and paperboard coatings in contact with aqueous and fatty foods. Please refer to the following for specific 21 CFR citations, as well as the tabular summary of FDA Listings within the Typical Physical Properties table on page 5 of this brochure.

21 CFR § 175.105: Indirect Food Additives – substances that can be safely used as components of adhesives.

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® 975P, K-FLEX® PG, K-FLEX® DP Plasticizers can be safely used as adhesive components intended for use in packaging, transporting, or holding food in accordance with the prescribed conditions and limitations listed in 21 CFR § 175.105.

21 CFR § 176.170: Indirect Food Additives – substances that can be safely used as components of the coated or uncoated food-contact surface of paper and paperboard intended for use in producing, manufacturing, packaging, processing, preparing, treating, packing, transporting or holding aqueous and fatty foods.

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® DP Plasticizers can be safely used in aqueous and fatty application areas in accordance with the prescribed conditions and limitations listed in 21 CFR § 176.170. Please see footnote* regarding the use of K-FLEX® 975P.

21 CFR § 176.180: Indirect Food Additives – substances that can be safely used as components of the coated or uncoated food-contact surface of paper and paperboard intended for use in producing, manufacturing, packaging, processing, preparing, treating, packing, transporting or holding dry food of the type(s) identified in 21 CFR § 176.170(c), Table 1.

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® DP Plasticizers can be safely used in dry application areas in accordance with the prescribed conditions and limitations listed in 21 CFR § 176.170. Please see footnote* regarding the use of K-FLEX® 975P.

***K-FLEX® 975P** can be used as a plasticizer at a level not to exceed 20% in an adhesive under 21 CFR 176.170 and 21 CFR 176.180, provided the adhesive is separated from the food by a functional barrier, or is limited to contact with food so as not to exceed trace amounts at seams and edges.

Emerald Performance Materials does not warrant that these product(s) are suitable under applicable food additive / food contact regulations of any potential use. The responsibility for determining the overall compliance with applicable food additive / food contact laws and regulations is with the company manufacturing the final consumer product and/or the person placing the products described herein in contact with food. This information is provided in good faith and is believed accurate as of the date of this letter. No warranty is subsequently expressed or implied. Liability is expressly disclaimed.

Bringing value with high quality products produced in our world-scale facilities with ISO 9001:2008 and ISO-14001:2004 certified management systems.



Global Inventory

K-FLEX® coalescents and plasticizers are included on or exempted from many global inventories. Please reference the product safety data sheet (SDS) for current global inventory status and other regulatory information. Current SDS's can be found on our website at www.kflex.emeraldmaterials.com or can be requested from product.compliance@emeraldmaterials.com.

U.S. OSHA Communication Standard

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® 975P, K-FLEX® PG and K-FLEX® DP are not regulated as hazardous substances.

Canadian WHMIS Classification

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® 975P, K-FLEX® PG and K-FLEX® DP are not regulated as hazardous substances.

STORAGE AND HANDLING:

At Emerald Kalama Chemical's production facility, the K-FLEX plasticizers are stored in type 304 stainless steel storage tanks. These storage tanks are nitrogen padded to reduce discoloration of the product. Type 304 stainless steel pipe and valves are also used. High density polyethylene has been shown to be suitable for product shipment but we have no direct experience in piping systems. Since K-FLEX products are excellent plasticizers for polyvinyl chloride (PVC), PVC piping systems should not be used. Sliding vane type positive displacement pumps have given us excellent service.

It is recommended that storage tanks be heated and insulated and that pumps and transfer piping also be heat-treated and insulated. Our engineers are always ready to discuss the storage and handling of any of our products.

Additional information can be found in the Material Safety Data Sheet.

* K-FLEX® 975P and K-FLEX® PG contain a component on Canada's NDSL.

K-FLEX® is a registered trademark of Emerald Performance Materials
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Committed to Excellence in Service and Manufacturing

As a leader in benzoate chemistry, we focus on operational excellence. We produce our K-FLEX product line in Rotterdam, the Netherlands and Kalama, Washington (USA), from operations strategically located on ports and rail lines to serve our customers globally. Both plants are backward integrated into key feedstocks to produce a wide array of benzoates, plasticizers, aroma chemicals and other intermediates.

Expanding Worldwide

We recently added a new technical center, expanded operations and installed and debottlenecked reactors to increase our global footprint.

Extending Our Portfolio and Capabilities

We have completed several acquisitions since our formation in 2006, expanding our offerings, expertise, and global reach. Most recently, we acquired a new aroma chemical operation in Widnes, United Kingdom in 2015.

Serving Customers Globally

Together, our plants ship over 200,000 MT to more than 70 countries annually. Our worldwide network includes partnerships with distributors and sales offices in Europe and Asia Pacific.



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Emerald Kalama Chemical is a business group of Emerald Performance Materials, a manufacturer of technologically advanced specialty chemicals for a broad range of consumer and industrial applications. Emerald® products play a variety of roles in the products that are consumed and used every day enabling them to last longer, look, smell, taste or perform better. They are used in aerospace, food, beverages, cosmetics, toothpaste, household products, paint, automobiles, sports gear and many other applications. Emerald has three business groups, six operations and approximately 700 employees.