

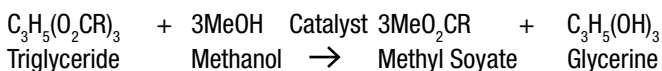
Soy-Based Solvents



The Product – Methyl Soyate

As companies strive to improve safety for their employees and meet regulatory requirements, interest in biobased products that can replace petroleum-based chemicals is growing. One of these renewable solutions is methyl soyate – an excellent petrochemical solvent replacement derived from soybean oil.

Methyl Soyate Process



Physical Properties of Methyl Soyate

TEST	VALUE	REFERENCE
Kauri-butanol number	58	ASTM D 1133
Volatile organic compounds	<50 g/l	EPA Method 24; SCAQMD Method 313
Flash point (closed cup)	>100° C	ASTM D 93
Specific gravity	0.885 – 0.905	ASTM D 1298
Density	7.3 lb./gal.	
Vapor pressure	<1.0 mm Hg	ASTM D 5191
Evaporation rate	0.0098	ASTM D 3539
Boiling point	216° C	ASTM D 2887
Viscosity	3.9 – 4.3 mm ² /sec	ASTM D 445
Moisture	<0.5%	ASTM D 2709
Cloud point	<2° C	ASTM D 2500
Iodine value	>130	ASTM D 1959
Acid number	<0.25%	ASTM D 664
Free glycerine	<0.02%	ASTM D 6584

Environmental Advantages

Made from soybean oil, methyl soyate offers many environmental and regulatory benefits. It is a non-ozone-depleting chemical (ODC), is non SARA (Superfund Amendments and Reauthorization Act) reportable, is readily biodegradable and offers potential for reduced waste-disposal costs.

Methyl Soyate Meets Environmental Regulations

- Clean Air Act (CAA; 1970, 1977, 1990): Methyl soyate is low in volatile organic compounds (VOCs) and is not classified as an ozone-depleting chemical or hazardous air pollutant (HAP), which means it passes CAA standards.
- Clean Water Act (1972, 1977): Methyl soyate has low aquatic toxicity and is readily biodegradable.

Methyl Soyate VOC Analysis

SAMPLE	VOLATILE % (LB./GAL.)	DENSITY	WATER %	VOC MINUS WATER	
				G/L	LB./GAL.
1	3.08	7.33	1.08	18	0.2
2	3.58	7.38	0.73	25	0.2
3	6.35	7.35	1.04	47	0.4
4	5.12	7.31	0.00	45	0.4

Testing was conducted using procedures outlined in EPA Method 24. Samples were used from four separate methyl soyate manufacturers.

Safety Advantages

Methyl soyate provides a safer alternative to chlorinated, petroleum and oxygenated solvents. It offers very low flammability, a very high flash point (greater than 360 degrees F), low VOC levels (<50 g/l), low toxicity and is not listed as a Hazardous Air Pollutant (HAP).

Methyl soyate toxicity:

- Acute oral: LD50 > 5,000 mg/kg
- Acute dermal: LD50 > 5,000 mg/kg
- Skin irritation: 1.6 (nonirritating)
- Eye irritation: Nonirritating
- Skin sensitization: Moderate potential
- Mutagenicity: None (Ames assay)

Methyl soyate can replace:

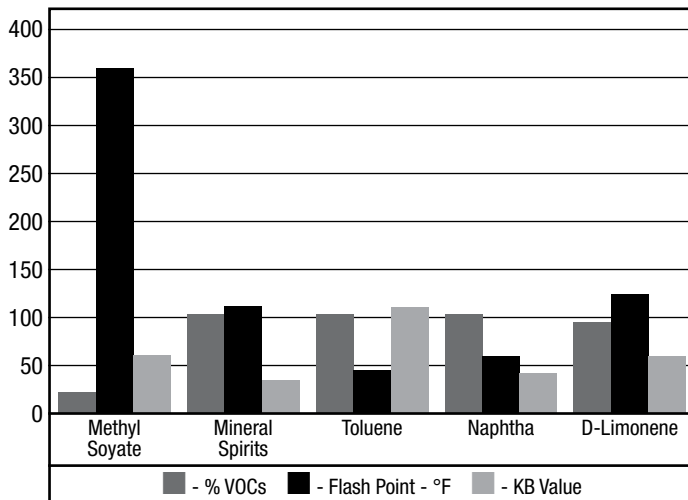
- Mineral spirits
- Methylene chloride
- Trichloroethylene
- Methyl ethyl ketone (MEK)
- Toluene
- d'limonene

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Performance Advantages

Because of its versatility, methyl soyate can be used to formulate many types of products. It provides effective solvency with a kauri-butanol (KB) value of 58 and is compatible with other organic solvents. Typically, methyl soyate is formulated with cosolvents or surfactants to optimize product performance characteristics such as drying rate and water solubility.



Market Applications for Methyl Soyate

Methyl soyate can be utilized in a number of different formulated products as a safe solvent replacement. Its excellent solvent properties make it adaptable to a wide range of performance requirements.

- I&I (Institutional & Industrial) cleaning products - This market has emerged as the largest use segment for soy-based formulated cleaners that are being marketed by numerous specialty chemical companies. These cleaners are used in plant maintenance, restaurants, hospitals, schools and households to safely replace mineral-spirits, chlorinated and citrus solvents as hard surface cleaners, general-purpose cleaners, glass cleaners, floor cleaners, bathroom cleaners, stainless steel cleaners and graffiti removers.
- Parts cleaning and degreasing - Methyl soyate can replace petroleum and chlorinated solvents such as mineral spirits and trichloroethylene in industrial parts-cleaning processes. Other uses include automotive cleaners, food-processing-equipment cleaning and asphalt cleaners.

- Paint, ink and adhesive removal - Applications include consumer and industrial paint strippers replacing methylene chloride; printing ink cleaners replacing toluene, adhesive and mastic removers; and graffiti removers replacing mineral spirits.
- Petroleum product cleanup - Methyl soyate can be used for effective cleaning of oil spills on beaches and inland waters, as well as cleaning refinery reactors, storage tanks and processing equipment.
- Carrier solvent - This developing use for methyl soyate involves alkyd paints, wood and concrete stains, and corrosion-protection products.
- Consumer products - The safe properties of methyl soyate make it ideal for use in hand cleaners, skin lotions and other personal care products.
- Fuels and lubricants - Uses for methyl soyate include lubricity additives, penetrating oils, metalworking fluids and form release agents for asphalt, concrete and metal fabrication. The largest use, however, is as the fuel base for biodiesel, which significantly reduces combustion emissions compared with petroleum diesel.

Emerging New Uses and Applications

The solvent market potential for soy solvents is not limited to the replacement of conventional solvents by methyl soyate. New solvents and applications are being developed by creative entrepreneurs that utilize the flexibility of soy chemistry.

Methyl soyate can be used as a shoreline cleaner to remove and recover spilled oil and petroleum products from beaches and streams. It is listed by the U.S. EPA on the National Contingency Plan product schedule for oil spills, and it is the only shoreline cleaner licensed by the state of California.

Another creative new use for soy solvents is the safe disposal of waste plastic products. Methyl soyate can dissolve 20 to 25 times its own volume of plastic waste such as Styrofoam flotation billets or shredded tire rubber. Dissolved scrap plastics have many use potentials such as paving product sealers and binders.

Other new emerging applications for soy-based solvent products and processes include paper pulp cleaning and recycling, bioremediation, highway paving and patching materials, and crude oil solvent extraction and processing.

