

AEROSOL[®] OT surfactants

Type:	Anionic	FDA Status:	
Chemical:	Sodium dioctyl sulfosuccinate	Approved 21 CFR 178.3400	
CAS No:	577-11-7	(OT-S: approved:	
Molecular Formula:	C ₂₀ H ₃₇ O ₇ NaS	21 CFR 175.105,	175.300, 175.320, 176.180,
Molecular Weight:	444	176.210, 177.1010,	177.1200, 177.1210,
EPA Status:	Exempt 40 CFR 180.1001 (c)	177.1650, 177.2260,	177.2600, 177.2800 only)

AEROSOL OT surfactant is an excellent wetting agent and emulsifier, characterized by its very quick migration to the interface. Its surface modifying properties can be utilized to reduce surface tension and to increase absorbency and penetration.

PHYSICAL AND CHEMICAL PROPERTIES

	OT-100	OT-75	OT-70-PG	OT-75-PG	OT-B	GPG	OT-S	OT-DEG	OT-N
VOC, ASTM method #24	Zero	0.64	1.44	1.28	Zero	0.80	2.47	0.83	0.65
Appearance at 25°C	waxy solid	clear slightly viscous liquid	clear slightly viscous liquid	clear slightly viscous liquid	white granular solid	clear slightly viscous liquid	transparent light amber liquid	clear slightly viscous liquid	clear slightly hazy viscous liquid
Solids, % by weight	98 min	75±1.0	70.5±1.5	75±1.0	98 min (83 active)	70±2.0	70±2.0	70±2.0	70±2.0
Moisture, % by weight maximum	2.0	–	–	–	2.0	–	0.5	–	–
Solvent or diluent	–	water alcohol	water propylene glycol	–	sodium benzoate	water alcohol	light petroleum distillate	water diethylene glycol	water alcohols
Color, APHA, maximum (50% solids)	100	35	50	50	–	125	150(as is)	125	75
Specific gravity, 25°C	1.1	1.09	1.09	1.09	1.1	1.08	1.0	1.07-1.1	1.09
Viscosity, cps @ 25°C	–	~200	100-300	100-300	–	~200	200-300	250-450	300 max
Melting point, °C	153-157	–	–	–	300	–	–	–	–
Flash point P-M (Pensky Marten), °F S (setaflash)	decomposes at 450	93 (pm)	>200	>200	chars before flash point reached	89(pm)	135(s)	>235	110(pm)
Freezing point, °C	–	-40	–	–	–	-40	–	–	–
pH, 1% solution	–	5-7	5-7	5-7	–	5-7	6-8	5-7	5-7
Acid number, as is maximum	2.5 (solid basis)	1.0	1.0	1.0	2.5	2.0	1.0	2.5 max.	2.0 max
Iodine value, as is maximum	0.25 (solid basis)	0.20	0.25	0.25	0.25	0.5	0.25	0.5 max.	0.5 max
Solubility (See also Tables 1, 2 and 3)									
Organic polar solvents	excellent	excellent	excellent	excellent	insoluble	excellent	excellent	excellent	excellent
Organic nonpolar solvents	excellent	good	good	good	insoluble	good	good	good	good
CMC %, % by weight	0.10-0.14	0.11-0.15	0.11-0.15	0.11-0.15	0.10-0.14	0.11-0.15	0.10-0.14	0.11-0.15	0.11-0.15
Shelf life	indefinite	1 year	1 year	1 year	indefinite	1 year	1 year	1 year	1 year



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PRT-073-I

SOLUBILITY

Table 1—Solubility Limits of AEROSOL OT Surfactant in Water, (based on solids)

Temperature		AEROSOL OT surfactant g/100 mL water
°C	°F	
25	77	1.5
30	86	1.8
40	104	2.3
50	122	3.0

Table 2—Interfacial Tension of Solutions of AEROSOL OT Surfactant (based on solids) in Water vs Mineral Oil and in Mineral Oil vs Water

Solution	Age of Interface	Interfacial tension, dynes/cm
0.1% AEROSOL OT-100 surfactant in mineral oil vs water	6 seconds	35.5
	30 seconds	31.2
	15 minutes	27.8
0.1% AEROSOL OT-100 surfactant in water vs mineral oil	1 minute	6.82
	5 minutes	6.08
	15 minutes	5.86

Table 3—Organic Solvents Capable of Solubilizing Aqueous Solutions of AEROSOL OT

Solvent	Solvent required for 10% solution, % by weight	Solvent required for 25% solution, % by weight
Acetone	17.5	—
Amyl alcohol (clear thick gel)	5.9	—
2-Butanol	11.5	—
Butyl Carbitol ¹ diethylene glycol monobutyl acetate	12.0	15.0
Butyl Cellosolve ¹ ester ethylene glycol monobutylether (q.v.)	12.0	15.0
Diacetone alcohol	18.0	15.0
Diethylene glycol	15.0	12.0
Ethanol (SDA 2-B)	15.0	12.0
Ethyl lactate	10.0	—
Furfuryl alcohol	7.4	—
Isopropyl alcohol	17.5	15.0
Methanol	12.5	13.0
Methyl acetate	15.0	15.0
Pine oil	not satisfactory	5.0
Tetrahydro furfuryl alcohol	9.9	—

¹ Product of Union Carbide Corp.

SURFACE TENSION

Table 4—Surface Tension of Solutions of AEROSOL OT Surfactant in Water, NaCl and Na₂SO₄

AEROSOL OT Concentration % solids	Water	Surface Tension, dynes/cm			
		0.25% NaCl	0.5% NaCl	1.0% Na ₂ SO ₄	2.0% Na ₂ SO ₄
0	72.0	—	—	72.5	72.8
0.001	68.6	52.4	40.1	42.0	41.5
0.005	57.3	—	—	—	—
0.02	45.9	26.3	25.3	25.9	26.0
0.1		24.9	24.8	24.6	25.2
0.25	29.0	24.5	25.2	25.6	25.4
0.5	27.5	25.3	25.5	25.2	25.2
1.0	26.1	Cloudy	Cloudy	Cloudy	Cloudy

ROSS-MILES FOAM TEST

Table 5

ASTM D-1173, 0.5% solution, 25°C	AEROSOL		
	OT-75	OT-B	GPG
Initial foam height, mL	320	315	335
Foam height after 15 minutes, mL	100	10	130

Table 6—Interfacial Tension (Pendant Drop Method) of Solutions of AEROSOL OT Surfactants vs Mineral Oil

Concentration of AEROSOL OT surfactant in water, % solids	Age of interface, minutes	Interfacial tension vs Mineral Oil, dynes/cm
None		Unaffected
	0.01	15(sec)
		1
0.05		21.7
		15
		20.7
0.01		11.8
		5
		11.0
0.25		10.7
		15
		10.7
0.01		6.82
		5
		6.08
0.25		5.86
		15
		5.86
0.5		4.37
		30(sec)
		5
1.0		3.98
		15
		3.58
0.5		3.54
		1
		3.48
1.0		3.41
		15
		3.41
1.0		1.97
		1
		1.92
1.0		1.92
		5
		1.85
1.0		1.84
		10
		1.84

Table 7–Solubility of AEROSOL OT Surfactant (except OT-B) in Organic Solvents

Method of Solution	Dissolved at room temperature	Heated then cooled	Specific gravity at 25°C		Surfactant in solution		Viscosity solution, poises
			Solvent	Solution	g/100 mL	% by weight	
	Carbon tetrachloride	–	1.59	1.31	73.8	56.4	1.65
	Petroleum ether	–	0.688	0.950	70.1	75.0	0.65
	–	Solvent naphtha	0.864	0.701	70.5	69.8	0.65
	–	Dibutyl phthalate	1.03	1.07	70.7	66.1	8.84
	–	Paraffin oil	0.881	1.00	69.5	69.5	12.9

Table 8–Interfacial Tension (Pendant Drop Method) of AEROSOL OT Surfactant in Water and Electrolyte Solutions vs Organic Liquids

Interfacial tension, dynes/cm at 25°C, surface age = 5 seconds

Concentration of OT, % Solids	OT in Water	OT in 0.25% NaCl	OT in 0.50% NaCl	OT in 1.0% Na ₂ SO ₄	OT in 2.0% Na ₂ SO ₄
AEROSOL OT Surfactant vs Toluene					
0	33.7	–	–	–	–
0.001	15.8	13.2	10.4	10.7	10.9
0.02	6.84	0.76	1.01	1.21	1.58
0.1	1.95	0.51	0.87	0.94	1.35
0.25	1.07	0.42	0.82	0.99	1.38
0.5	0.66	0.38	0.74	0.84	1.27
1.0	0.38	Cloudy	Cloudy	Cloudy	Cloudy
AEROSOL OT Surfactant vs Mineral Oil					
0	54*	–	–	–	–
0.02	16.8*	3.43	2.13	3.02	2.49
0.1	5.86*	1.14	2.12	1.72	1.42
0.25	3.58*	1.14	1.02	1.38	1.33
0.5	3.41*	1.09	1.02	1.17	1.28
1.0	1.84*	Cloudy	Cloudy	Cloudy	Cloudy
AEROSOL OT Surfactant vs Carbon Tetrachloride					
0	44.7	–	–	–	–
0.001	36.0	30.9	37.1	36.4	38.0
0.02	12.00	0.92	1.00	1.62	1.62
0.1	1.15	0.51	0.94	Cloudy	1.67
0.25	0.86	Cloudy	Cloudy	Cloudy	1.59
0.5	0.54	Cloudy	Cloudy	Cloudy	Cloudy
1.0	Cloudy	Cloudy	Cloudy	Cloudy	Cloudy
AEROSOL OT Surfactant vs Air					
0	72.0	–	–	72.5	72.8
0.001	62.8	52.4	40.1	42.0	41.5
0.02	38.9	26.3	25.3	25.9	26.0
0.1	28.7	24.9	24.8	24.6	25.2
0.25	28.5	24.5	25.2	25.6	25.4
0.5	27.5	25.3	25.5	25.2	25.2
1.0	26.0	Cloudy	Cloudy	Cloudy	Cloudy

*Age of interface = 15 seconds.

WETTING (DRAVES TEST)**Table 9–Draves Sinking Time in seconds at 25±1 °C AEROSOL OT Surfactant (based on solids)**

% Concentration	0.5	0.25	0.1	0.05	0.025	0.01
Time in seconds	<0.2	<0.2	3.0	6.0	16.6	52.5

ELECTROLYTE TOLERANCE**Table 10–Calcium Tolerance**

AEROSOL OT Surfactant Concentration, % solids	Calcium Tolerance ppm
0.01	2250
0.025	630
0.05	520
0.10	250
0.25	340
0.50	540

REPRESENTATIVE APPLICATIONS FOR AEROSOL OT SURFACTANT

Aerosol OT, besides being an excellent wetting agent, also finds utility in a number of applications requiring emulsification, stabilization and dispersion. A few representative applications where Aerosol OT exhibits distinct performance advantages are listed below:

PRINTING INK / OVERPRINT VARNISH SYSTEMS

Aerosol OT is widely used as a wetting/leveling agent in water-based printing ink formulations due to the following reasons:

- Rapid and dramatic lowering in surface tension of the formulation, leading to improved wetting of the substrate. This in turn improves adhesion, gloss and color resolution.
- Improved flow characteristics, leading to uniform coating of the substrate.
- Rapid wetting is compatible with very fast printing rates.

EMULSION POLYMERIZATION

Aerosol OT can also be used as a primary or co-emulsifier, and as a post-add, for the manufacture of a wide variety of latex types, especially acid/AMD-modified styrene-butadiene latexes. It exhibits the following performance features as an emulsifier in latex systems:

- Low cmc provides efficient particle generation at low usage level.
- Can produce latexes with very low particle size and narrow distribution.
- Latexes produced with Aerosol OT have very low levels of coagulum, and high conversion and molecular weight.
- Works very well with Aerosol MA-80I and Aerosol A-196 as a co-emulsifier in styrene-butadiene latex systems.
- Extremely effective as a post-add in all types of latexes (including acrylic, styrene-acrylic, vinyl acetate, vinyl acrylic, styrene-butadiene) in lowering surface tension and improving flow and leveling characteristics.

MISCELLANEOUS APPLICATION AREAS FOR AEROSOL OT

- **Textile and Paper:** very effective as a wetting and dispersing agent.
- **Paint Formulations:** provides excellent flow and leveling characteristics, as well as promoting better wetting and hence paint adhesion. Its excellent organic solubility also makes it compatible with a wide variety of paint additives/formulations.
- **Dry Cleaning:** The very good wetting, dispersing, penetrating, and emulsifying capability of Aerosol OT can make it very effective in liquid dry cleaning formulations. It is also very effective in cleaning solutions for glass windows, automobile windshields, etc.

- **Agricultural:** Aerosol OT-B is widely used in the preparation of readily wettable and dispersible agricultural free-flowing powder formulations.
- **Anti-Stat:** Aerosol OT is effective as an anti-stat/softening agent.
- **Organic/Hydrocarbon-Based Systems:** Aerosol OT-S is very compatible and effective as a wetting/solubilizing/dispersing agent in a wide variety of organic/hydrocarbon/oil-based systems.
- As a wetting agent for a number of substrates such as metal, glass, plastic, etc.

FDA STATUS

AEROSOL OT surfactant (except for OT-S) is permitted under 21 CFR 178.3400 of the Food Additives Regulations for use as an emulsifier and/or surface active agent in the manufacture of any non-food article intended for food-contact use. There are no limitations on the nature or amount of use of AEROSOL OT surfactant other than the general limitations set forth in Section 174.5 which are applicable to every substance listed in Subpart D.

AEROSOL OT-S is permitted by 21 CFR 175.105 as a component in adhesive formulations. AEROSOL OT-S is also permitted by 176.18 as a component of paper and paperboard in contact with dry food as well as 21 CFR 176.210, defoaming agents used in the manufacture of paper and paperboard.

BIODEGRADABILITY

AEROSOL OT surfactant is readily biodegraded. In the CSMA Shake Culture Test, AEROSOL OT surfactant was completely biodegraded within two days when sewage was acclimatized to AEROSOL OT surfactant.

EPA STATUS¹

Under the provisions of 40 CFR 180.1001 (c) of the Pesticide Chemicals Regulations, AEROSOL OT surfactant is exempted from the requirement of a tolerance when used in accordance with good agricultural practice as an inert ingredient of pesticide formulations applied to growing crops or to raw agricultural commodities after harvest.

¹ 21 CFR 182.99 Adjuvants for Pesticide Chemicals—Adjuvants, identified and used in accordance with 40 CFR 180.1001 (c) and (d), which are added to pesticide use dilutions by a grower or applicator prior to application to the raw agricultural commodity, are exempt from the requirement of tolerance.

HEALTH AND SAFETY INFORMATION

AEROSOL OT-100

The single oral LD₅₀ of AEROSOL OT-100 administered as a 20% aqueous solution for young male albino rats is approximately 4.2 g/kg. The LD₅₀ by 24-hour with the clipped skin of male albino rabbits is greater than 10 g/kg. AEROSOL OT-100 is irritating to rabbit eyes but not rabbit skin.

Human patch tests were performed using 0.30g samples of petrolatum dispersions of AEROSOL OT-100 for induction and challenge applications. The 2.5% by weight dispersion was used for induction and the 1.0% by weight dispersion was used for challenge. An induction application was applied to the skin under occlusion on the forearm or upper back of 100 subjects for 10 alternate-day 24-hour periods. Each site was evaluated for irritation after removal of the patches.

After a one-week rest period, a challenge application of the test material was applied to a fresh site on the forearm or upper back of each subject for a 24-hour period. Each challenge site was appraised after removal of the patches and 24 hours thereafter for evidence of contact allergy.

There was some mild redness in 19 of the 100 subjects which appeared after the third application during the 10 alternate-day induction period. The 24-hour challenge application produced no abnormality of the skin.

This product was administered at a level of 1% in the diet to rats for six months. There were no adverse effects from oral consumption of this material. The active ingredient in this product was also administered orally to dogs at daily doses up to 30 mg/kg for one year. There were no compound related effects observed.

This product was fed to three generations of rats at doses of 0.1, 0.5 and 1% in the diet. Although there was a reduction in body weight of pups, there was no effect on growth and development or reproductive performance. At levels up to 1%, this product had no adverse effects on the reproductive function of either sex in any generation.

AEROSOL OT-75

The single oral LD₅₀ AEROSOL OT-75 administered as a 20% aqueous solution for young male albino rats is greater than 5 mL/kg and the LD₅₀ by 24-hour contact with the clipped skin of male albino rabbits is greater than 10 mL/kg. AEROSOL OT-75 is irritating to rabbit eyes but not rabbit skin.

AEROSOL OT-75 contains ethyl alcohol which is identified in Section 1910.1000 of the regulations to the Occupational Safety and Health Act. Employee exposure to ethyl alcohol as an air contaminant must be limited according to the provisions of this regulation.

Human patch test results for AEROSOL OT-75 were identical to those obtained for AEROSOL OT-100.

AEROSOL OT-70PG

The single oral LD₅₀ of AEROSOL OT-70-PG administered as a 20% aqueous solution for young male albino rats is greater than 5 mL/kg. and the LD₅₀ by 24-hour contact with the clipped skin of male albino rabbits is greater than 10 mL/kg. AEROSOL OT-70-PG is irritating to rabbit eyes but not rabbit skin.

Human patch test results for AEROSOL OT-70-PG were identical to those obtained for AEROSOL OT-100.

AEROSOL OT-B

The single oral LD₅₀ of AEROSOL OT-B administered as a 20% aqueous solution for young male albino rats is greater than 5 g/kg and the LD₅₀ by 24-hour contact with the clipped skin of male albino rabbits is greater than 10 g/kg. AEROSOL OT-B is irritating to rabbit eyes but not rabbit skin.

A cotton fabric sample was prepared containing 0.5% by weight of AEROSOL OT-B. This cotton sample was used as the test material in a patch test involving 200 adult human subjects. A 15-mm patch of the test material was moistened and applied under occlusion on the forearm or upper back of each subject for one week. Each induction site was evaluated for irritation after removal of the patches.

After a one-week rest period, a similar application of the test material was applied to a fresh site on the forearm or upper back of each subject for another week. Each challenge site was appraised after removal of the patches for evidence of contact allergy.

There were no signs of irritation on any of the 200 subjects at the end of the first week of exposure. Similarly, the second week of exposure produced no abnormality of the skin.

AEROSOL GPG

The single oral LD₅₀ of AEROSOL GPG administered as a 20% aqueous solution for young male albino rats is greater than 5 mL/kg and the LD₅₀ by 24-hour contact with the clipped skin of male albino rabbits is greater than 10 mL/kg. AEROSOL GPG is irritating to rabbit eyes but not rabbit skin.

AEROSOL GPG contains ethyl alcohol which is identified in Section 1910.1000 of the regulations to the Occupational Safety and Health Act. Employee exposure to ethyl alcohol as an air contaminant must be limited according to the provisions of this regulation.

Human patch test results for AEROSOL GPG were identical to those obtained for AEROSOL OT-100.

AEROSOL OT-N

The single oral LD₅₀ AEROSOL OT-N administered as a 20% aqueous solution for young male albino rats is greater than 5 mL/Kg and the LD₅₀ by -24-hours contact with the clipped skin of male albino rabbits is greater than 10 mL/Kg. AEROSOL OT-N is irritating to rabbits eyes but not rabbit skin.

AEROSOL OT-N contains ethyl alcohol and isopropanol which are identified in Section 1910.1000 of the regulations to the Occupational Safety and Health Act. Employee exposure to ethyl alcohol/isopropanol as an air contaminant must be limited according to the provisions of this regulation.

Human patch test results for AEROSOL OT-N were identical to those obtained for AEROSOL OT-100

AEROSOL OT-S

The single oral LD₅₀ of AEROSOL OT-S administered as a 20% aqueous solution for young male albino rats is greater than 5 mL/kg and the LD₅₀ by 24-hour contact with the clipped skin of male albino rabbits is greater than 10 mL/kg. AEROSOL OT-S is irritating to rabbit eyes but not rabbit skin.

AEROSOL OT-S contains a petrolatum distillate as this class of compounds is identified in Section 1910.1000 of the regulations to the Occupational Safety and Health Act. Employee exposure to petrolatum distillates as air contaminants must be limited according to the provisions of this regulation.

Human patch test results for AEROSOL OT-S were identical to those obtained for AEROSOL OT-100.

AEROSOL OT-DEG

The single oral LD₅₀ of AEROSOL OT-DEG administered as a 20% aqueous solution for young male albino rats is greater than 5,000 mg/kg, and the LD₅₀ by 24-hour contact with clipped skin of male albino rabbits is greater than 2,000 mg/kg. AEROSOL OT-DEG is irritating to rabbit eyes and causes none to very mild irritation to rabbit skin.

Human patch test results for AEROSOL OT-DEG were identical to those obtained for AEROSOL OT-100.

STORAGE AND HANDLING

AEROSOL OT-75 and GPG surfactants are Class I flammable liquids. Precautions should be followed for this classification. AEROSOL OT-S surfactant is a Class II combustible liquid. AEROSOL OT-100 surfactant is stable under a wide variety of storage conditions. Solutions of AEROSOL OT surfactant may be stored and used in a

wide variety of containers or reaction vessels. Stainless steel, aluminum and Monel alloy are recommended for reaction and storage vessels; glass and rubber are suitable lining materials. Some of the sprayed resinous coatings are satisfactory in stationary tanks in which the coating can be built up more heavily than is customary in drums. In permanent installations, however, the added expense of aluminum, stainless steel or clad-steel is frequently justified.

Containers filled with AEROSOL OT-75 surfactant should be kept closed when not in use, as evaporation of water and solvent may cause gelation. The system composed of AEROSOL OT-75 surfactant plus water and solvent is sensitive to loss of liquid through evaporation causing reversion to a gel state. The quality of the AEROSOL OT-75 surfactant is not affected by this physical change.

If a batch of AEROSOL OT-75 surfactant should gel, a small amount of ethanol should be added and the drum rolled until the gel has disappeared (1-2% of ethanol on the weight of the batch is sufficient). To effect more rapid liquefaction, the drum should be put in a steam-heated chest.

The efficacy of AEROSOL OT-75 surfactant is not impaired by freezing and thawing. However, if a freeze-thaw occurs, it is recommended that the entire contents of the container be agitated prior to use.

IMPORTANT NOTICE

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TSCA INFORMATION

This product is manufactured in compliance with all provisions of the Toxic Substances Control Act, 15 U.S.C.

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