HAMPOSYL N-Acyl Sarcosinate Surfactants

Typical Properties

HAMPOSYL Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants are anionic surfactants available in several acid and salt grades.

HAMPOSYL Acids

HAMPOSYL	L Lauroyl Sarcosine	C Cocoyl Sarcosine	M Myristoyl Sarcosine	O Oleoyl Sarcosine	S Stearoyl Sarcosine
Active Ingredient	94% min.	94% min.	94% min.	94% min.	94% min.
Free Fatty Acid	6% max.	6% max.	6% max.	6% max.	6% max.
Color, Gardner	2 max.	3 max.	2 max.	4 max.	4 max.
Appearance	white	pale	white	yellow	white
@25°C	waxy solid	yellow liquid	waxy solid	liquid	waxy solid
Typical					
Specific Gravity @ 25°C	.97-.99	.97-.99	.97-.99	.95-.97	.96-.98
Softening Point	34°-37°C	18°-22°C	48°-53°C	—	53°-58°C
Average Molecular Wt. of Active Ingredient	270	280	298	349	338

HAMPOSYL Salts

HAMPOSYL	L-30 Sodium Lauroyl Sarcosinate Solution	L-95 Sodium Lauroyl Sarcosinate Powder	C-30 Sodium Cocoyl Sarcosinate Solution	M-30 Sodium Myristoyl Sarcosinate Solution
Active Ingredient	30%±1%	94% min.	30%±1%	30%±1%
pH, 10% solution	7.5-8.5	7.5-8.5	7.5-8.5	7.5-8.5
Sodium Soap	2% max.	4% max.	2% max.	2% max.
Color, APHA, as is	60 max.	80 max. (20% sol.)	100 max.	100 max.
Appearance	colorless liquid	dry white powder	colorless to very pale yellow liquid	clear to slightly turbid liquid
Typical				
Specific Gravity @ 25°C	1.02-1.03	approx. 25 lbs./cu. ft.	1.02-1.03	1.02-1.03
Freezing Point	-1°C	—	-1°C	-1°C
Average Molecular Wt. of Active Ingredient	292	292	301	320

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HAMPOSYL N-Acyl Sarcosinate Surfactants

In Soap Bars

HAMPOSYL
Surfactants

Soap bars can be formulated to take advantage of the excellent lather and skin feel contribution of HAMPOSYL† N-Acyl Sarcosinate Surfactants.

Sarcosinate can be incorporated into soap bars in three ways.

A 30% solution of sodium N-acyl sarcosinate can be incorporated into the soap base with subsequent stripping of the excess moisture by heating the mixture under vacuum.

Spray dried sodium lauroyl sarcosinate powder can be added to the soap base. This can result in a somewhat gritty feel when the product is used in cold water, as is the case when micronized sodium cocoyl isethionate is used.

It has recently been discovered[1], that molten N-acyl sarcosine acids, which are typically liquid below 40°C, can act as solvents for other soap making ingredients such as fatty acids or their salts, producing low viscosity solutions at less than 70°C. When these solutions are allowed to cool, they set to hard soap like solids, which produce copious lather and an elegant skin feel at skin pH.

The neutral pH can be achieved by neutralizing the acyl sarcosine acid with alkaline soaps such as sodium stearate, as depicted in Examples 1 and 2.

Example 1: Combination Soap Bar with Cocoyl Sarcosine

1. 40 grams cocoyl sarcosine.
2. Approximately 48 grams sodium stearate (Witco C1). Adjust pH to 6-7.
3. Pour liquid into molds and allow to set.

Example 2: Combination Soap Bar with Lauroyl Sarcosine and Coco Isethionate

1. 40 grams lauroyl sarcosine.
2. 20 grams n-cocoyl isethionate.
3. Approximately 48 grams sodium stearate. Adjust pH to 6-7.

Procedure for Examples 1 and 2

1. Heat N-acyl sarcosine to 70-100°C.
2. Dissolve co-surfactant (e.g., sodium coco isethionate) optional.
3. Dissolve fatty acid salt (e.g., sodium stearate, sodium laurate, etc.), until desired pH is obtained (e.g., 6-7)*.
4. Pour warm homogeneous liquid into molds and allow to set.

Since the product is remeltable, it may be processed by conventional techniques.

*The pH is determined by adding aliquots of the molten liquid to a beaker of deionized water on a magnetic stirrer and measuring the equilibrium pH.

† Trademark of Chattem Chemicals, Inc., An Elcat Company

[1] J.J. Crudden, U.S. Patent 5,186,855, Assigned to W.R. Grace & Co., 1993.

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HAMPOSYL N-Acyl Sarcosinate Surfactants

In Skin Care Products

HAMPOSYL
Surfactants

The mildness and compatibility of HAMPOSYL† N-Acyl Sarcosinate Surfactants makes them excellent components of skin care formulations. They combine with soap to produce systems that foam at skin pH, thereby reducing irritancy. By forming a protective layer on skin, these surfactants reduce irritancy and moisture loss.

A list of attributes that have made sarcosinates important and useful ingredients in skin care products is presented in Table 1.

Table 1: Attributes of Sarcosinates in Skin Care Products

- Mildness.
- Compatibility with surfactants and soaps.
- Combines with soap to produce systems which foam at skin pH, thereby reducing irritancy.
- Forms a protective layer on skin, thereby reducing irritancy and moisture loss.
- Does not inactivate medicinal actives such as salicylic acid or benzoyl peroxide.
- Will solubilize Triclocarban in non-aqueous systems.
- Does not deactivate cationic conditioners.
- Provides copious foam and an elegant skin feel.

Sarcosinates are presently used in a wide range of facial cleansers. A formulation for a mild, high lathering, facial cleansing gel which incorporates both acyl glutamate and sodium lauroyl sarcosinate is presented in Table 2.

Table 2: Clear Facial Cleansing Gel

Component	Composition (w/w) %
Sodium cocoyl glutamate	40.0
Sodium lauroyl sarcosinate	10.0
Cocamide DEA	10.0
Glycerol	5.0
Water, perfume, preservative	q.s.

Mix ingredients, heat to 50°C until clear, cool.

Because of their strong and gentle cleaning action, combined with their ability to produce stable lather even in the presence of sebum and sodium chloride, the sarcosinates have been used in shower gels and bath foams. A formulation for a mild shower gel which incorporates sarcosinate along with an amphoteric surfactant and sodium dodecyl sulfate is presented in Table 3.

Table 3: Mild Shower Gel

Component	Composition (w/w) %
Cocoamphoglycinate	23.0
Sodium lauroyl sarcosinate, 30%	20.0
Sodium dodecyl sulfate, 30%	20.0
Hydroxypropyl methylcellulose (E4M)	0.3
Water, perfume, preservative	q.s.

Mix ingredients, heat to 50°C and adjust pH to 7.0 with lactic acid, cool.

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HAMPOSYL N-Acyl Sarcosinate Surfactants

Biodegradability and Physiological Properties

HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants are readily biodegradable. These products have been thoroughly investigated for their mildness and low toxicity. They are recognized as safe and effective surfactants.

Biodegradability

Biodegradation rates of various HAMPOSYL surfactants were determined over a 41 day period, using the biochemical oxygen demand protocol published by the American Public Health Association. The figures for sodium lauryl sulfate are presented for comparison in Table 1. All the materials tested are readily biodegradable.

Table 1: Biodegradability of HAMPOSYL surfactants. Biological oxygen demand of the surface active agents after a 41 day incubation period (A.P.H.A. Protocol).

Surface Active Agent	% COD	% of Theoretical Oxygen Demand
HAMPOSYL L	83	78
HAMPOSYL C	76	74
HAMPOSYL O	76	70
Sodium Lauryl Sulfate	65	67

Physiological Properties

HAMPOSYL sarcosinate surfactants have been thoroughly investigated for their mildness and low toxicity and have, as a result, found wide application in personal care products. HAMPOSYL sarcosinates have been used for many years and are recognized as safe and effective surfactants. For complete information, please request a copy of “Physiological Properties of the HAMPOSYL Sarcosinates.”

Acute Oral Toxicity

Acute oral toxicity of various HAMPOSYL surfactants to mammals was compared to lauroyl iminodiacetic acid and to sodium lauroyl sulfate. The data summarized in Table 2 shows that acyl sarcosines are significantly less toxic than sodium lauryl sulfate.

Table 2: Acute Oral Toxicity

Product	LD_{50}, mg/kg	Remarks
Sodium Lauroyl Sarcosinate	2175, 5000	mice, rats
Sodium Cocoyl Sarcosinate	4200	rats
Cocoyl Sarcosine	5400	rats
Sodium Oleoyl Sarcosinate	6000	rats
Lauroyl Iminodiacetic Acid	2600, 4200	rat, females rat, males
Sodium Lauryl Sulfate	1288	rats

Aquatic Toxicity

The aquatic toxicity of lauroyl sarcosine to fish is significantly less than other anionic surfactants. Using the protocols described in ASTM Designation E729-88a it was determined that the 96 hour LC_{50} of lauroyl sarcosine for rainbow trout is 56 mg active ingredient per liter (Table 3). The aquatic toxicity of sodium dodecyl sulfate generally ranges from 1-10 mg per liter.

Table 3: Fish Toxicity, Rainbow Trout

Lauroyl Sarcosine	
24 hour LC_{50}	93 mg/liter
48 hour LC_{50}	61 mg/liter
72 hour LC_{50}	56 mg/liter
96 hour LC_{50}	56 mg/liter
100% dead at 72 mg/liter	
100% survived at 46 mg/liter	
LC_{50} for Sodium Lauryl Sulfate is typically 1-10 mg/liter.	

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HAMPOSYL N-Acyl Sarcosinate Surfactants

In Hair Care Products

HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants are ideal ingredients for shampoos. They form rich, stable lather, even in the presence of sebum and hard water. These products are particularly effective between pH 4 and 7, the normal pH of skin and hair.

Some of the reasons why sarcosinates are widely used in hair care products are presented in Table 1.

Table 1: Attributes of Sarcosinates in Hair Care Products

- Forms rich stable lather even in the presence of sebum and hard water.
- Enhances lather formation on SDS, alpha olefin sulfonates, betaines, etc.
- Is particularly effective between pH 4 and 7, the pH of skin and hair.
- Is mild to skin and eyes.
- Conditions hair by adsorbing strongly as a mono-layer, thereby reducing static and improving combability.
- Sarcosinates do not defat skin or strip hair.
- They are compatible with all surfactant types.
- They stabilize formulations by reducing krafft points and increasing cloud points.

Sarcosinates, since they are compatible with cationic surfactants[1], can be used to produce cationic conditioning crème rinse shampoos[2]. A typical formulation is presented in Table 2.

Table 2: High Lather Crème Rinse Shampoo

Component	Composition (w/w) %
Sodium lauroyl sarcosinate, 30%	20.0
Coco betaine, 35%	10.0
Lauramide DEA	5.0
Cetrimonium chloride, 30%	0.8
Steralkonium chloride, 25%	0.1
Disodium DTA	0.2
Water, perfume, preservative	q.s.

Adjust pH to 6.7

This is high lathering, conditioning shampoo which allows wet combability.

Acyl sarcosinates have also been used in antidandruff shampoos containing colloidal sulfur, which use a metal chelate complex such as disodium cupric EDTA to suppress the off odor caused by the sulfur, as demonstrated by the formulation in Table 3, which was taken from a patent by Brinkman and Vogenthaler[3].

Table 3: Antidandruff Shampoo

Component	Composition (w/w) %
Sodium lauroyl sarcosinate, 30%	4.0
Colloidal sulfur	4.0
Sodium chloride	6.0
Sodium coconut alkyl glyceryl sulfonate	30.0
N-cocoyl sarcosine	0.7
FD&C blue dye no. 1	0.4
Perfume	0.5
Succinic acid	1.0
Disodium cupric ethylenediaminetetraacetate	0.5
Distilled water	q.s.

Sarcosinates can also be used to produce antidandruff shampoos containing zinc pyrithione, which lathers strongly even on oily hair. A formulation is presented in Table 4.

Table 4: Antidandruff Shampoo for Oily Hair

Component	Composition (w/w) %
Sodium lauroyl sarcosinate, 30%	10.0
TEA dodecyl sulfate, 40%	25.0
Zinc pyrithione, 48%	4.2
Magnesium aluminum silicate	1.0
Hydroxypropylmethyl cellulose, E4,000	1.25
Water, perfume, color	q.s.

Disperse magnesium aluminum silicate and HPMC, E4,000 in water and allow to stand overnight. Add the rest of the ingredients.

This antidandruff shampoo is a thick flowable liquid which lathers richly, even on oily hair.

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[1] A.W. Bouchal, U.S. Patent 2,921,885, Assigned to Colgate-Palmolive Co., 1960.
[2] J.R. Hart and E.F. Levy, Soap Cosmetics & Chemical Specialties, August 1977.
[3] R.E. Brinkman and R.L. Vogenthaler, U.S. Patent 4,089,945, May 1978.

Greeb[4], in U.S. Patent 4,772,424, describes the use of mixtures of betaine, sarcosinate and alkyl sulfate to produce clear isotropic shampoos of high activity.

A crystal clear acid balanced shampoo can be produced as described in Table 5.

Table 5: Crystal, Clear, Acid Balanced Shampoo

Component	Composition (w/w) %
Part 1:	
Sodium lauroyl sarcosinate, 30%	30.0
Lauryl dimethyl amine oxide, 30%	5.0
Polyquaternium 7 (Merquat 550)	1.0
Part 2:	
Polyol alkoxy ester (Crothix)	0.7
Disodium EDTA	0.3
Water	64.0

Disperse Crothix in hot water and add with strong agitation to Part 1. A clear solution forms. While still hot, adjust pH to 5.7 by adding citric acid solution with strong agitation.

This crystal clear odorless shampoo produces copious lather with mild conditioning.

Perren et. al.[5], in a patent assigned to Procter & Gamble, showed that sodium N-acyl sarcosinate in combination with sodium alkyl glyceryl ether sulfonate caused synergistic enhancement of lather, as well as contributing in other ways to the performance of products using the blend.

A transparent liquid shampoo patented by Anderson[6] and assigned to Proctor & Gamble is based on a mixture of sarcosinate, lauryl ether sulfate and alkanolamides, as outlined in Table 6.

Table 6: Sarcosinate Shampoo

Component	Composition (w/w) %
Triethanolamine lauryl ether sulfate (3 moles ethylene oxide)	4.0
Triethanolamine cocoyl sarcosinate	10.0
Monoethanolamide of coconut fatty acids	3.0
Diethanolamide of coconut fatty acids	3.0
EDTA, partial triethanolamine salt	0.65
Ethanol	7.0
Methyl cellulose (4000 cps)	0.75
Perfume	0.75
Water	q.s.
pH adjusted to 6.7	

The product was claimed to produce copious lather with good texture in both hard and soft water, with easy rinsing and to leave the hair soft, lustrous and manageable.

[4] H.R. Greeb, U.S. Patent 4,772,424, Assigned to Procter & Gamble, September 1988.
[5] J. J. Parran, E.W. Lang and D.D. Whyte, U.S. Patent 2,979,465, Assigned to Procter & Gamble, April 1961.
[6] J.J. Anderson, U.S. Patent 3,085,067, Assigned to Procter & Gamble, April 1963.

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HAMPOSYL N-Acyl Sarcosinate Surfactants

In Oral Care Products

HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants reduce dental decay by inhibiting acid producing hexokinase enzyme. They also inhibit bacterial flora and reduce Halitosis (bad breath).

The attributes of N-acyl sarcosinates, which have contributed to their success in oral care products, are outlined in Table 1.

Table 1: Attributes of Sarcosinates in Oral Care

- Reduces dental decay by inhibiting acid producing hexokinase enzyme
- Inhibits bacterial flora
- Reduces Halitosis (bad breath)
- Exhibits strong detergency
- Provides good rheology
- Mild taste in pure form
- Non-toxic
- Biodegradable
- Synergism with SDS
- Compatible with salts such as sodium bicarbonate
- Compatible with enzymes and germicides

In 1954, William King showed, in a patent assigned to Colgate-Palmolive[1], that sodium lauroyl sarcosinate, Gardol®*, when incorporated into dentrifices, inhibited dental caries for more than 24 hours after a single use. The sarcosinate acts as a bacterial hexokinase inhibitor and its prolonged action is due to its strong adsorption on dental plaque and other surfaces in the oral cavity. A formulation for dental cream, from the patent, is presented in Table 2.

Table 2: Dental Cream

Component	Composition (w/w) %
Calcium carbonate	12.1
Dicalcium phosphate dihydrate	36.2
Sodium N-lauroyl sarcosinate	2.0
Glycerine	30.6
Water	15.3
Irish moss	1.0

A mouthwash formulation from the same source is presented in Table 3.

Table 3: Mouthwash

Component	Composition (w/w) %
Sodium N-lauroyl sarcosinate	0.2
Ethyl alcohol	10.0
Flavor	0.15
Saccharin (soluble)	0.012
Distilled water	q.s.

In a later patent[2], King incorporated stannous fluoride into formulations containing sarcosinate for added protection against caries. A formulation from this patent is presented in Table 4.

Table 4: Dental Cream

Component	Composition (w/w) %
Sodium lauroyl sarcosinate	4.1
Stannous fluoride	0.2
Sec. calcium phosphate dihydrate	86.0
Magnesium silicate	7.0
Flavoring materials	2.5
Saccharin (soluble)	0.2

In 1960, a patent assigned to Colgate-Palmolive, by Bouchal[3], showed that sarcosinates, surprisingly, can be combined with potent cationic germicides in oral care products to produce systems with enhanced germicidal activity. A mouth rinse formulation from the patent, presented in Table 5, was shown to prevent bacterial growth over a 300% greater area than the quaternary alone, when evaluated by the Disk Halo Method.

Table 5: Mouth Rinse

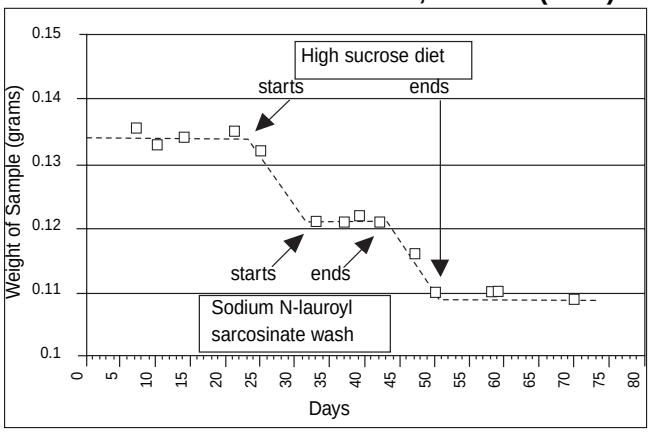
Component	Composition (w/w) %
Diisobutyl cresoxyethoxylethyl-dimethylbenzyl ammonium chloride	0.03
Sodium N-lauroyl sarcosinate	0.20
Polyoxyethylene tridecyl alcohol (EO12)	0.25
Ethanol	15.00
Adjuvants (color, flavor, fragrance)	0.20
Water (distilled)	84.32

† Trademark of Chattem Chemicals, Inc., An Elcat Company.
* Gardol is a registered trademark of Colgate-Palmolive.

[1] W.J. King, U.S. Patent 2,689,170, Assigned to Colgate-Palmolive Co., September 1954.
[2] W.J. King, German Patent 1,060,095, Assigned to Colgate-Palmolive Co., June 1959.
[3] A.W. Bouchal, U.S. Patent 2,921,885, Assigned to Colgate-Palmolive Co., 1960.

Kenneth Tomlinson, in a paper published in the Journal of Cosmetic Chemistry[4], showed by an in-vivo study, which involved retaining slices of accurately weighed dentine in the oral cavity where they could be submitted to conditions which promote and prevent dental decay, that the use of a N-acyl sarcosinate mouthwash could completely stop the loss of dentine, even in the presence of high levels of sucrose. As can be seen from Figure 1, no dentine is removed by dissolution even in the presence of a high sucrose diet while the sarcosinate mouthwash is being used.

Figure 1: In Vivo Screening of Anti-caries Agent Kenneth Tomlinson—Colgate-Palmolive Weight Loss of Dentine Journal of Cosmetic Chemists 29, 385-397 (1978)



More recent studies carried out in Japan have shown that N-acyl sarcosinate:

- Exhibits a prolonged inhibitory effect on halitosis or bad breath[5]
- Stabilizes mutanase which can be used as an anti-caries agent in dentifrices[6]
- Can stabilize bacteriolytic enzymes and enhance their activity[7]

The N-acyl sarcosinates have also been used in translucent sodium bicarbonate containing toothpaste[8] and in peroxide gel dentifrice compositions[9] where formulation presented in Table 6 was found to be stable with respect to viscosity and peroxide activity over a 12 month period.

Table 6: Peroxide Gel Dentifrice

Component	Composition (w/w) %
Carbopol 940	1.50
Polyethylene glycol 400	30.00
Glycerine 99.6%	25.00
Butylated hydroxy anisole	0.50
Hydrogen peroxide (35% solution)	10.00
Sodium saccharin	0.50
Mixed flavor oils	1.00
Calcium pyrophosphate	29.00
Sodium lauroyl sarcosinate	1.50
Tetrasodium pyrophosphate	1.00

[4] K. Tomlinson, J. Soc. Cosmetic Chemists, 29, pp 285-397, 1978.
[5] I. Masao, T. Fumihiko and K. Masaki, (Lion Corp.) Japan Kokai Tokkyo Koho, JP6137, 720 [8737, 720], July 1984.
[6] Japan Kokai Tokkyo Koho, JP59, 152, 314 [84, 152, 314], Sunstar Inc., August 1984.
[7] E. Abe, M. Inoue and T. Morioka, Koku Eisei Gakki Zasshi, 28 (4) pp 536-542, 1979.
[8] A.E. Winston and R.M. Miskewitz, U.K. Patent Application 2,220,568A by Church & Dwight Co., Inc., 1990.
[9] J. Drucker, Eur. Patent Application EP0325267A2 by Carter Wallace, Inc., 1989.

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HAMPOSYL N-Acyl Sarcosinate Surfactants

Performance in Surfactant Systems

HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants enhance the performance of other surfactants when combined in surfactant systems. Favorable effects have been exhibited on Krafft point, cloud point, soap activation at neutral pH, and surface tension.

Krafft Point Depression

The sarcosinates have been shown(1) to depress the Krafft point of anionic surfactants such as sodium dodecyl sulfate and sodium cocoyl isethionate, when used as co-surfactants. This allows the systems to retain activity and remain homogeneous at lower temperatures.

Cloud Point Elevation

The sarcosinates have also been found to elevate the cloud point of ethoxylated nonionic surfactants.

Activation of Soap at Neutral pH

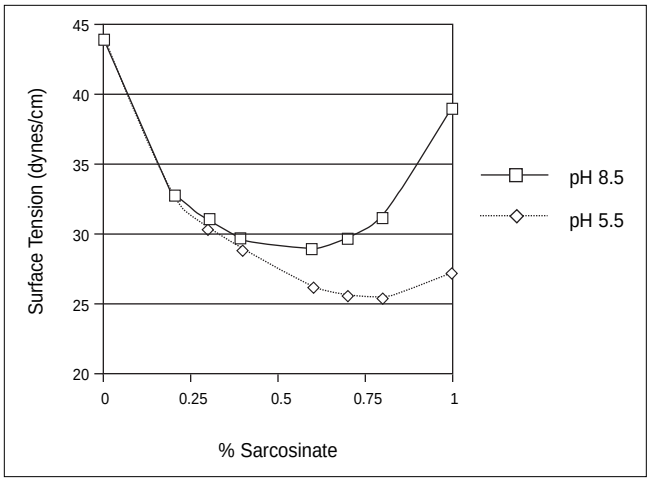
Conventional soap performs well only at high pH. However, mixtures of sarcosinates and soap function well at a pH of 7 and below.

Synergistic Surface Tension Reduction

The sarcosinates, being anionic surfactants, exhibit the expected compatibility with anionic, nonionic and amphoteric surfactants. However, unlike most other anionic surfactants they also exhibit compatibility with cationic surfactants over extended concentration ranges. Furthermore, mixing sarcosinates with other surfactants can result in synergistic reduction of surface tension, depression of CMC and enhancement of lather stability.

The surface tension of a 1% solution of surfactant varying from pure lauryl pyridinium chloride to pure sodium lauroyl sarcosinate at alkaline and acidic pH is presented in Figure 1.

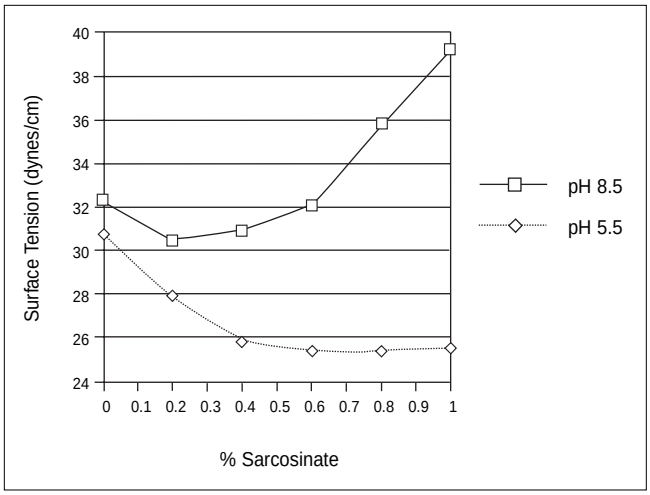
Figure 1: Surface Tension vs. Composition (1% Solution) NA LS: Lauryl Pyridinium Chloride



A 20% addition of sarcosinate reduces the surface tension of the system by 12 dynes cm^{-1} at both acidic and alkaline pHs.

Sarcosinate also enhances the activity of amphoteric surfactants as evidenced by Figure 2.

Figure 2: Surface Tension vs. Composition (1% Solution) NA LS: Cocamphopropionate



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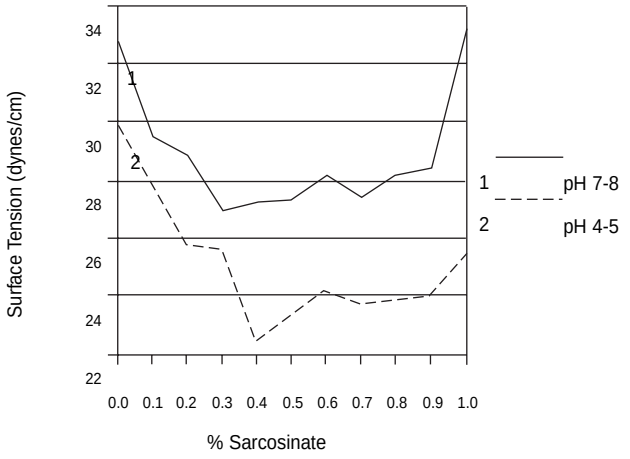
(1) J.J. Crudden, B.J. Lambert and R.W. Kohl, "Industrial Applications of Surfactants III," ed. D.R. Karsa, pp 95-119, Royal Society of Chemistry, 1992.

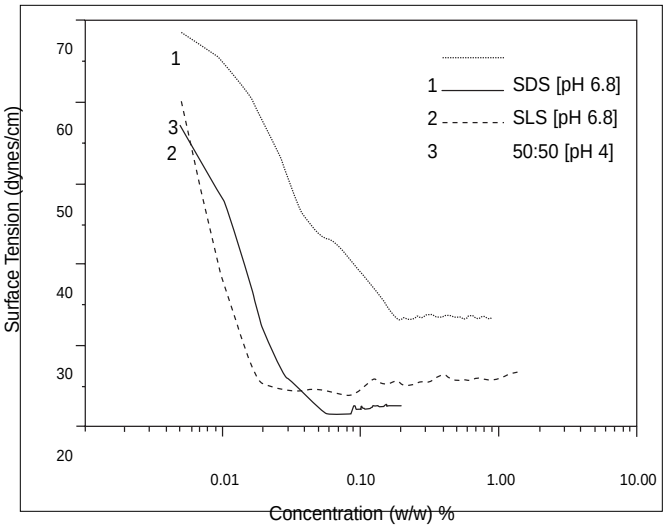
A similar study carried out using lauryl dimethyl amine oxide with sodium lauroyl sarcosinate is presented in Figure 3. Synergistic surface tension reduction was also detected in this system.

Figure 3: Surface Tension vs. Composition (1% Solution) NA Lauroyl Sarcosinate: Lauryl Dimenthylamine Oxide



Sodium lauroyl sarcosinate also strongly reduces the surface tension of systems containing SDS. It can be seen from Figure 4, that the minimum surface tension on the mixed system in 25 dynes cm^{-1} and the CMC is lower than that of either surfactant.

Figure 4: Sodium Lauroyl Sarcosinate and Sodium Dodecyl Sulfate Dependence of Surface Tension on Concentration



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HAMPOSYL N-Acyl Sarcosinate Surfactants

Germicidal Effects

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Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants have been shown(1) to exhibit germicidal effects under acidic conditions. They have good activity against straph aureus below pH 5.8 and against pseudomonas auregenosa below pH 4. They have also been shown to inhibit the bacterial flora of human saliva at concentrations below 0.25%.

The sarcosinates are compatible with a wide range of cationic conditioning agents and germicides. Sometimes with synergistic enhancement of activity. A list of germicides compatible with sarcosinates is presented in Table 1.

Table 1: Antibacterial Compounds that are Compatible with Acyl Sarcosine Surfactants

Quaternary Ammonium Compounds		
Benzalkonium Chloride	Lauralkonium Chloride	Quaternium 5
Benzethonium Chloride	Laurtrimonium Chloride	Quaternium 12
Cetakonium Chloride	Methylbenzethonium Chloride	Quaternium 14
Cetrimonium Chloride and Bromide	Myristalkonium Chloride	Quaternium 17
	Myrtrimonium Bromide	Stearalkonium Chloride
Cetylpyridinium Chloride	Quaternium 2	Steartrimonium Chloride
Phenolics		
o-Benzyl-p-Chlorophenol	2,4-Dichlorophenol	Resorcinol
Coal tar	Hexachlorphene	Salicylic Acid
o-Chlorophenol	Hexylresorcinol	Thymol
p-Chlorophenol	Pentachlorophenol	2,4,5-Trichlorophenol
Chlorothylmol	Phenol Tribromosalan	
Chloroxylenol (PCMX)	o-Phenylphenol	
Dichlorophene		
Others		
Benzoyl Peroxide	Chlorhexidine and Salts	Sulfur
Benzyl Alcohol	Retinoic Acid Zinc Pyrithione	
2,4-Dichlorobenzyl Alcohol		

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(1) Anonymous, Research Disclosures, 14449, p 56, 1976.

3708 St Elmo Avenue, Chattanooga, TN 37409, Telephone: 423-822-5000 Fax: 423-825-0507

HAMPOSYL N-Acyl Sarcosinate Surfactants

Substantivity and Skin Protection

HAMPOSYL
Surfactants

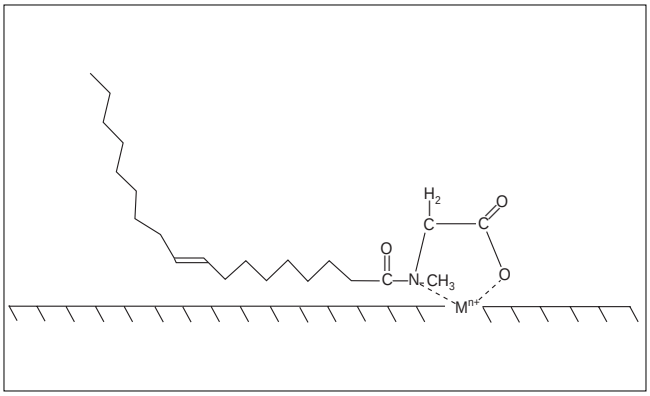
HAMPOSYL† N-Acyl Sarcosinate Surfactants have been shown to adsorb strongly on human hair. The substantivity is increased at lower pH and on hair that was damaged by peroxide bleaching. These surfactants have also been shown to protect human skin from irritation caused by some components of detergent formulations.

Substantivity and Skin Protection

Nelson and Stewart[1] showed, using C_{14} isotopic labeling, that sarcosinates absorb strongly on casein gelatin and human hair. They found the substantivity to be enhanced at lower pH and on hair that was damaged by peroxide bleaching.

Studies by Salensky et. al.[2], have showed that when oleoyl sarcosine absorbs on metal, surface chelation occurs through the amino acid portion of the molecule. They found that the carboxylate moiety orients itself almost vertically and concluded that the surface metal is chelated by cyclization of the head group on positively charged sites as depicted in Figure 1.

Figure 1: Adsorption of N-oleoyl Sarcosine on Metal



A hydrophobic protective film of N-acyl sarcosine can reduce the corrosion of metal by acids by a factor of 10[1], and a similar hydrophobic protective film on skin may well be responsible for sarcosinates having the ability to reduce the irritation caused by some components in cleanser formulations.

Dvorkovitz et. al.[3] in a patent assigned to Diversey Corporation, showed that sodium lauroyl sarcosinate reduced the dermal irritation caused to guinea pigs by irritating components of detergent formulations. Some data from the patent is presented in Table 1. Zero represents no irritation and five represent maximum irritation.

Table 1: Effect of Sodium Lauroyl Sarcosinate on Reducing Skin Irritation Caused by Various Detergent Components

	Irritation Value	
Component	**Additive Alone**	**Additive with NaLS**
Sodium Metasilicate	4.0	0.5
Soda Ash	2.5	0.5
Trisodium Phosphate	1.0	0.0
Triton X100	1.5	0.5
Oronite D60	2.0	1.0

Dvorkovitz et. al., U.S. Patent No. 2,962,448, Nov. 29, 1960.

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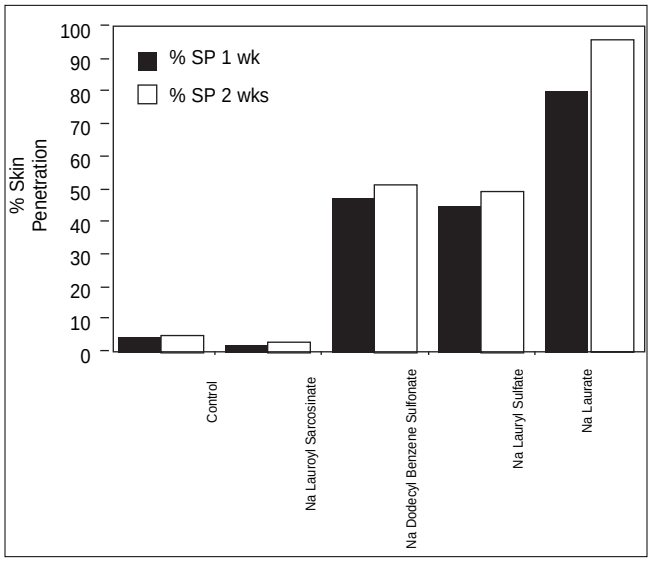
[1] M.F. Nelson, Jr. and D. Stewart, Jr., J. Soc. Cosmetic Chemists, 7, pp 122-131, 1956.
[2] G.A. Salensky, M.G. Cobb and D.S. Everhart, Ind. Eng. Chem. Prod. Res. Dev., 25, pp 133-140, 1986.
[3] V. Dvorkovitz, N.W. Berst and G.G. Leist, U.S. Patent 2,962,448, Assigned to Diversey Corporation.

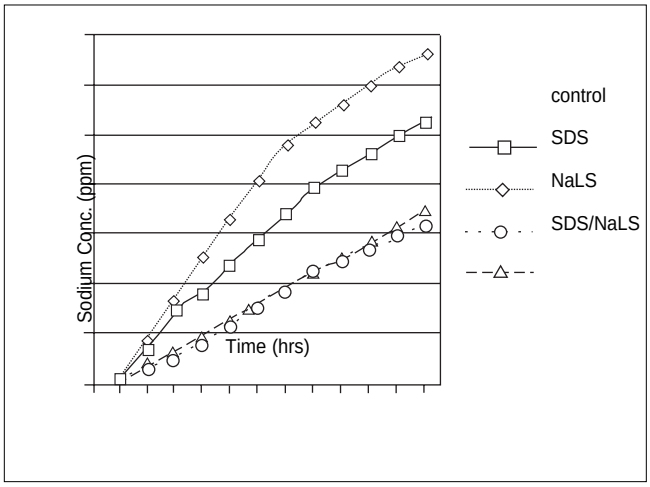
Bettley[4] used full thickness human skin in a diffusion cell experiment to determine the irritation potential of various surfactants. He hypothesized that if irritating components could not penetrate the epidermis to living tissue then no irritation could be caused. In a diffusion cell experiment, he determined the potential of various surfactants to compromise the barrier properties of skin. The method involved tracking the rate of diffusion of sodium, from a sodium chloride solution, across the skin from the outside, into deionized water on the inside, when various surfactants were added to the salt solution. As can be seen from Figure 2, the presence of sodium laurate and sodium lauryl sulfate strongly enhance the permeation rate whereas sodium lauroyl sarcosinate reduces the rate of permeation to less than that of the control, which contains no surfactant.

Figure 2: Epidermal Permeability at 0.04M NA*



A recent study[5], using methods similar to Bettley's, confirmed that sodium lauryl sulfate enhances the permeability of human skin to sodium, whereas sodium lauroyl sarcosinate reduces it. Furthermore, it also shows that when sodium lauroyl sarcosinate is used in combination with sodium dodecyl sulfate, the overall effect is to limit the permeation to below that of the control, as depicted in Figure 3.

Figure 3: Transdermal Cumulative Sodium at pH 7.0



Jungermann and Silberman[6] have shown, in an experiment using excised human callus, that cocoyl sarcosine retards the uptake of moisture from solution by the tissue, but that when the tissue is removed from the solution the rate of moisture loss is retarded to below that of the control. The use of soap, by contrast, seemed to result in ultimate dehydration of the tissue to a level below that of the control, some time after the tissue was removed from the solution.

[4] F.R. Bettley, Brit J. Dermatol., 77, pp 98-100, 1965.
[5] A.J. Ward, Clarkson University, Potsdam, New York, work in progress.
[6] E. Jungermann and H.C. Silberman, J. Soc. Cosmetic Chemists, 23, pp 139-152, March 1972.

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3708 St Elmo Avenue, Chattanooga, TN 37409, Telephone: 423-822-5000 Fax: 423-825-0507

HAMPOSYL N-Acyl Sarcosinate Surfactants

Lather and Foam Formation and Stability

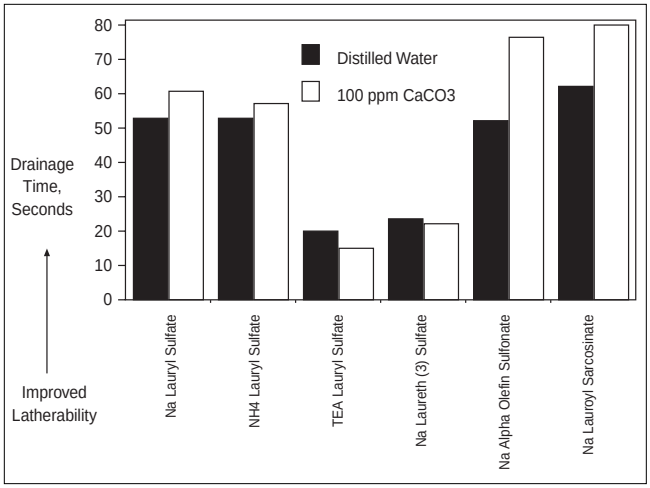
HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants are effective foaming and lathering agents. These surfactants show increased lather drain times in the presence of sebum which allows them to perform effectively even in shampoos for oily hair. They also foam well in electrolyte solutions and in the presence of conditioning agents in conditioning shampoos.

The sarcosinates are effective foaming and lathering agents. Foam is usually produced under conditions of low shear. Foam stability can be quantified using the Ross Miles test. Lather, by contrast, is produced under conditions of high shear, such as that generated when washing hair. Lather stability of surfactant systems can be quantified using the method of Hart and DeGeorge[1]. In this method, the time required for the lather, formed by agitating a surfactant solution in a Waring Blender for 60 seconds, to drain through a funnel placed on a 20 mesh sieve is determined. A wire stretched across the inside of the funnel, near the bottom, allows easy determination of the end point. The results of the test have been found to correlate very well with the effectiveness of surfactant solutions used in personal care products.

The lather drainage times of many surfactants[2], such as sodium laureth sulfate and TEA Lauryl Sulfate are reduced by the presence of 100 ppm calcium carbonate, as seen in Figure 1. By contrast, this level of calcium carbonate markedly increases the lather drainage time for sodium lauroyl sarcosinate.

Figure 1: Effect of Water Hardness on Lather Drainage Time of Various Surfactants at 0.80% Active

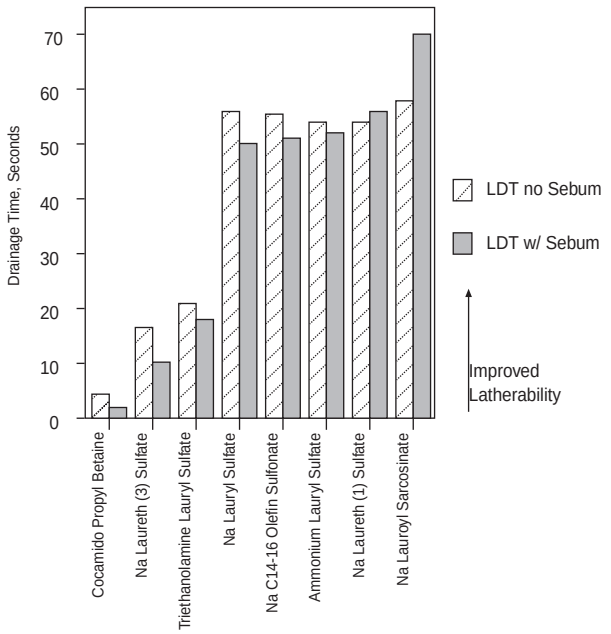


Sarcosinates, unlike many surfactants, also show increased lather drainage times in the presence of sebum; as can be seen from Figure 2. This allows them to function effectively even in shampoos for oily hair.

† Trademark of Chattem Chemicals, Inc., An Elcat Company

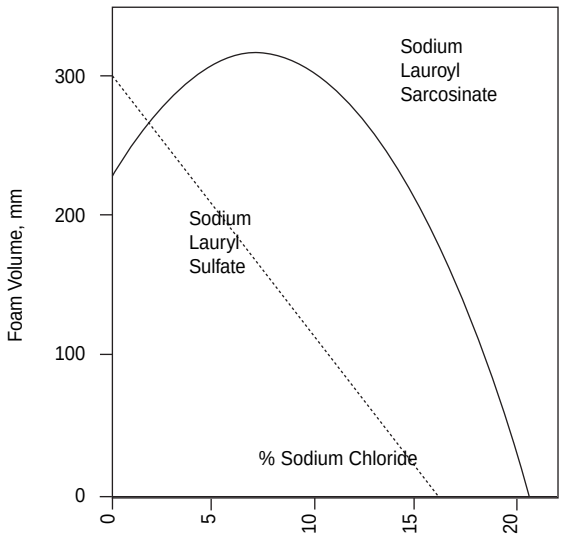
[1] J.R. Hart and M.T. DeGeorge, J. Soc. Cosmetic Chemists, 31, pp 223-236, Sept./Oct. 1980.
[2] J.R. Hart, Cosmetics & Toiletries, Vol. 100, March 1985.

Figure 2: Lather Drainage Time for Various Surfactants (1% active) in the Presence and Absence of Sebum



Sarcosinates foam well in electrolyte solution; Figure 3. The foam volume produced by sodium lauroyl sarcosinate is actually increased by the presence of sodium chloride, up to a maximum of about 8% salt. By contrast, the foam volume produced by sodium lauryl sulfate is depressed by the addition of any salt. A blend of both surfactants shows intermediate salt tolerance.

Figure 3: Effect of Sodium Chloride on Foaming



Hart and DeGeorge[3] studied the effect of conditioning ingredients on the lather drainage times of a wide range of surfactant systems. They concluded that N-acyl sarcosinates and alpha olefin sulfonates are the most useful anionic surfactants for conditioning shampoos, due to their resistance to delathering by the conditioning agent.

[3] J.R. Hart and M.T. DeGeorge, Cosmetics & Toiletries, Vol. 89, No. 2, pp 49-54, February 1983.

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HAMPOSYL N-Acyl Sarcosinate Surfactants

Surface Tension and CMC

HAMPOSYL
Surfactants

This data sheet provides the minimum surface tension and CMC of HAMPOSYL† N-Acyl Sarcosinate Surfactants. Also described is the effect of pH on surface tension.

The minimum surface tension and CMC of some common sarcosinates, determined using the Willhelmy Plate Technique at pH 7, is presented in Table 1.

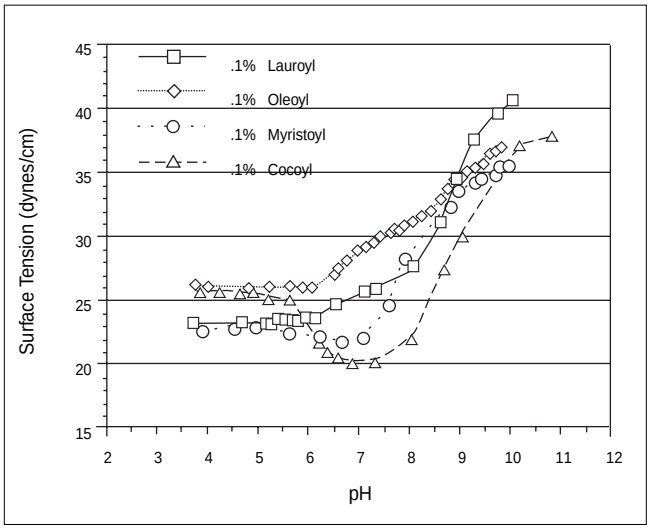
Table 1: Surface Properties

	CMC, (w/w) %	Minimum Surface tension dynes/cm
Sodium Lauroyl Sarcosinate	8.0×10^{-2}	24.3
Sodium Myristoyl Sarcosinate	7.9×10^{-3}	27.2
Sodium Cocoyl Sarcosinate	8.7×10^{-3}	22.7
Sodium Oleoyl Sarcosinate	2.6×10^{-3}	28.0
Sodium Lauryl Sulfate	2.4×10^{-1}	33.5

Dependence of Surface Tension of pH

The variation in surface tension of 0.1% solutions of the sarcosinates from Table 1, with pH, is presented in Figure 1. In each case, the surface tension is highest above pH 9 and decreases rapidly as the pH is decreased towards 7. For each surfactant the surface tension reaches a minimum between pH 7 and 5.5, with the cocoyl sarcosinate showing a deep minimum around pH 7. Below pH 5, the insoluble acid form of the surfactant begins to predominate and can be seen to separate out as a second phase.

Figure 1: N-acyl Sarcosinates; pH Dependence of Surface Tension



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HAMPOSYL N-Acyl Sarcosinate Surfactants

Biodegradability and Physiological Properties

HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants are readily biodegradable. These products have been thoroughly investigated for their mildness and low toxicity. They are recognized as safe and effective surfactants.

Biodegradability

Biodegradation rates of various HAMPOSYL surfactants were determined over a 41 day period, using the biochemical oxygen demand protocol published by the American Public Health Association. The figures for sodium lauryl sulfate are presented for comparison in Table 1. All the materials tested are readily biodegradable.

Table 1: Biodegradability of HAMPOSYL surfactants. Biological oxygen demand of the surface active agents after a 41 day incubation period (A.P.H.A. Protocol).

Surface Active Agent	% COD	% of Theoretical Oxygen Demand
HAMPOSYL L	83	78
HAMPOSYL C	76	74
HAMPOSYL O	76	70
Sodium Lauryl Sulfate	65	67

Physiological Properties

HAMPOSYL sarcosinate surfactants have been thoroughly investigated for their mildness and low toxicity and have, as a result, found wide application in personal care products. HAMPOSYL sarcosinates have been used for many years and are recognized as safe and effective surfactants. For complete information, please request a copy of “Physiological Properties of the HAMPOSYL Sarcosinates.”

Acute Oral Toxicity

Acute oral toxicity of various HAMPOSYL surfactants to mammals was compared to lauroyl iminodiacetic acid and to sodium lauroyl sulfate. The data summarized in Table 2 shows that acyl sarcosines are significantly less toxic than sodium lauryl sulfate.

Table 2: Acute Oral Toxicity

Product	LD_{50}, mg/kg	Remarks
Sodium Lauroyl Sarcosinate	2175, 5000	mice, rats
Sodium Cocoyl Sarcosinate	4200	rats
Cocoyl Sarcosine	5400	rats
Sodium Oleoyl Sarcosinate	6000	rats
Lauroyl Iminodiacetic Acid	2600, 4200	rat, females rat, males
Sodium Lauryl Sulfate	1288	rats

Aquatic Toxicity

The aquatic toxicity of lauroyl sarcosine to fish is significantly less than other anionic surfactants. Using the protocols described in ASTM Designation E729-88a it was determined that the 96 hour LC_{50} of lauroyl sarcosine for rainbow trout is 56 mg active ingredient per liter (Table 3). The aquatic toxicity of sodium dodecyl sulfate generally ranges from 1-10 mg per liter.

Table 3: Fish Toxicity, Rainbow Trout

Lauroyl Sarcosine	
24 hour LC_{50}	93 mg/liter
48 hour LC_{50}	61 mg/liter
72 hour LC_{50}	56 mg/liter
96 hour LC_{50}	56 mg/liter
100% dead at 72 mg/liter	
100% survived at 46 mg/liter	
LC_{50} for Sodium Lauryl Sulfate is typically 1-10 mg/liter.	

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Skin Irritation

Testing of the acyl sarcosinates by the epicutaneous patch test had shown that these materials are highly compatible with the skin. In this test, the products are applied to the skin of highly eczematic persons (aqueous solutions were left to dry on the skin). These experiments demonstrated excellent skin compatibility, i.e., practically no reaction, and the sarcosinates were shown to be superior even to acyl taurides and isethionates. Numerous skin tests on animals have confirmed the mildness of the sarcosinate surfactants.

HAMPOSYL L-30 and C-30 surfactants were tested for primary skin irritation as described in CFR 16, 1500.41 Federal Hazardous Substances Act—Consumer Products Safety Commission. HAMPOSYL L-30 surfactant produced primary irritation scores of 0.83 for four hour skin exposure, indicating that this product is not a primary skin irritant under CFR 16.

Antimicrobial Activity

The antimicrobial activity of sodium lauroyl sarcosinate is strongly pH dependent. At pH's greater than 7, practically no antimicrobial activity is found. There is good activity at pH 5.8 against staphylococcus aureus, streptococcus faecalis, tricophyton mentagrophytes, pityrosporum ovale, and high activity against pseudomonas aeruginosa at about pH 4. Lauroyl and oleoyl sarcosine have been found to exhibit virucidal activity. It has been reported that sodium lauroyl sarcosinate disrupts the outer cell membrane of gram-negative bacteria without denaturing cell proteins. This effect is useful in isolating biotechnology products from genetically-transformed microorganisms[1].

In contrast with other anionic surfactants, sodium lauroyl sarcosinate may be combined with antimicrobials, such as quaternary ammonium compounds. In fact, sodium lauroyl sarcosinate can enhance the antimicrobial activity of these materials.

[1] T. Evans, International Patent Appl. PCT/US86/01289, applied for by the Upjohn Company.

HAMPOSYL N-Acyl Sarcosinate Surfactants

Active Ingredient Analytical Methods

HAMPOSYL
Surfactants

Analytical procedures to determine concentrations of active ingredient are available for both acid and salt forms of HAMPOSYL† N-Acyl Sarcosinate Surfactants.

Procedure for HAMPOSYL Acids

Reagents:

Sodium Hydroxide, 0.1 Normal, Standardized
Isopropanol, neutralized to phenolphthalein endpoint with 0.1N NaOH
Phenolphthalein, 1% alcohol solution

Procedure:

Weigh accurately a 0.5 to 0.6 gram sample into a 250 ml beaker. Add 50 mls of neutral isopropanol and warm on a steam bath until dissolved *(Caution: Isopropanol is flammable. Do not heat over an open flame!)* Add 50 mls of distilled water and 5 drops of phenolphthalein. Titrate with 0.1N NaOH to first appearance of faint pink color.

Calculation:

The acid number of neutralization equivalent is directly derived from the above procedure as follows:

$$\text{Neutralization Equivalent} = \frac{(\text{wt. of sample in grams})\ (1{,}000)}{(\text{mls. of NaOH})\ (\text{Normality})}$$

Procedure for HAMPOSYL Sarcosinate Salts

Reagents:

Hydrochloric Acid, 1.0 Normal, Standardized
Diethylether
Bromphenol Blue Indicator, 0.05%

Procedure:

Weigh accurately about 20 grams of sample into a 600 ml beaker. Add 50 mls of distilled water, 100 ml of diethylether *(Caution: Diethylether is very flammable and its vapors can be explosive)*, and 4 drops of bromphenol blue. Titrate with 1.0N HCl to a greenish-yellow endpoint, adding a few additional drops of indicator as the endpoint is approached.

Calculation:

$$\text{Active Ingredient, \%} = \frac{(\text{mls of HCl})\ (\text{Normality})\ (\text{Factor})}{\text{wt. of sample in grams}}$$

The factors are as follows:

HAMPOSYL L-30	29.2
HAMPOSYL C-30	30.1
HAMPOSYL M-30	32.0

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HAMPOSYL N-Acyl Sarcosinate Surfactants

Synthesis

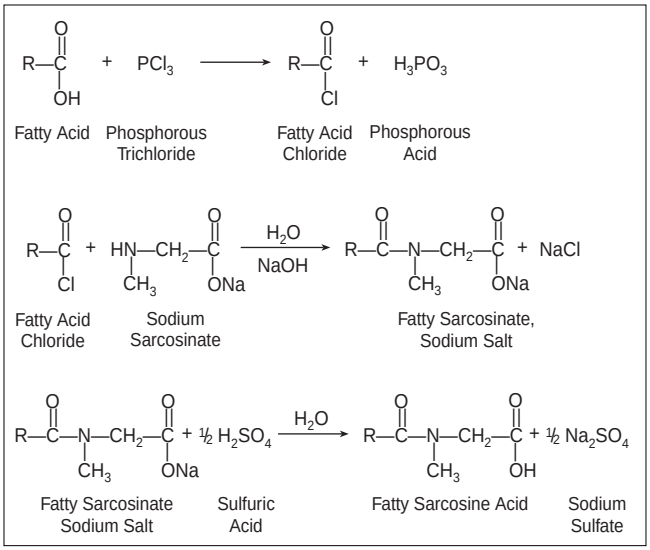
HAMPOSYL
Surfactants

HAMPOSYL† surfactants are mild, biodegradable anionic surfactants produced from fatty acids and the amino acid sarcosine.

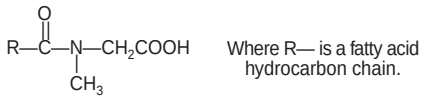
Synthesis

Sarcosine is a naturally occurring amino acid. It can be produced by thermal decomposition of caffeine in the presence of barium carbonate. Sodium sarcosinate is manufactured commercially from formaldehyde, sodium cyanide, and methyl amine.

HAMPOSYL surfactants are condensation products of sodium sarcosinate and a fatty acid chloride (Figure 1). The fatty acid chloride is reacted with sodium sarcosinate under alkaline conditions to produce the fatty sarcosinate sodium salt, which is water soluble. Upon acidification, the fatty sarcosine acid, which is water insoluble, is formed and may be isolated from the reaction medium. The acyl sarcosines may be neutralized with bases such as sodium, potassium, ammonia, or triethanolamine to produce aqueous solutions.



The HAMPOSYL surfactants are anionic wetting agents represented by the formula:



See Table 1.

Table 1: Typical % Fatty Acid Chain Distribution in Sarcosinates

	Saturated							Unsaturated			
	C_6	C_8	C_{10}	C_{12}	C_{14}	C_{16}	C_{18}	$1{=}C_{16}$	$1{=}C_{18}$	$2{=}C_{18}$	$3{=}C_{18}$
Cocoyl	1.0	7.0	6.0	49.0	18.0	8.0	6.0		5.0		
Lauroyl			0.5	99.0	0.5						
Myristoyl				1.0	98.0	1.0					
Oleoyl	[1.0 ←			10.0			→ 1.0]	6.0	71.0	10.0	2.0

They are modified or “interrupted” soaps which, while being very soap-like, possess many of the more desirable properties of synthetic surfactants.

HAMPOSYL surfactants are available commercially in the acid form and generally as solutions of the sodium salts. The dry form of sodium lauroyl sarcosinate is also commercially available as HAMPOSYL L-95 surfactant. Other salts (e.g., ammonium, potassium, triethanolamine, etc.) and other fatty acid chains may be made available upon request.

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HAMPOSYL surfactants offer:

- Outstanding lather building and resistance to sebum delathering
- Excellent foaming and wetting
- Rapid biodegradability
- Good detergency
- Outstanding mildness to skin and eyes
- Compatibility with quaternary ammonium germicides and conditioners
- Substantivity, imparts good feel, softness, and lubricity to skin and hair
- Raises cloud point of other surfactants and lowers Krafft point
- Improved moisture retention in the skin
- Excellent corrosion inhibition
- Wide compatibility with medicated ingredients
- Good tolerance to hard water
- Resistant to oxidation
- High salt tolerance
- Solubility in highly alkaline systems
- High performance in neutral to moderately acidic formulations

Additional Literature

Literature is available on the properties and uses of HAMPOSYL sarcosinate surfactants. Included are:

- N-Acyl Sarcosine Surfactants (reprint)
- Sarcosinate-Cationic Crème Rinse Shampoos (reprint)
- The Lathering Potential of Surfactants—A Simplified Approach to Measurement (reprint)
- The Effect of Conditioning Ingredients on the Lathering potential of Anionic Surfactants (reprint)
- Surface Active Thickeners: Effect on Lathering (reprint)
- Shampoo Lather—A Reliable Test (reprint)
- Sarcosinate Surfactants in Skin Cleansers (reprint)
- Improving Medicated Products with Sarcosinate Surfactants (reprint)
- Hamposyl Products in Formulating Carpet Cleaners
- Liquid Soaps—A Challenge for the Formulator (reprint)
- Formulating for Improved Lather (reprint)
- Physiological Properties of HAMPOSYL Sarcosinates
- Shampoo Formulations
- The Shampoo Surge—What's Happening in Formulation (reprint)
- Bath and Shower Product Formulary
- Sarcosinate Surfactants as Isolating Agents in Biotechnology
- Current FDA Approved Indirect Food Uses of HAMPOSYL Surfactants

HAMPOSYL N-Acyl Sarcosinate Surfactants

In Analgesic Creams

HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants may be used in formulations of topical analgesic creams.

A formulation for a topical analgesic cream containing cocoyl sarcosine and triethanolamine has been published by the American Colloid Company, see Table 1.

Table 1: Analgesic Cream

Component	Composition (w/w) %
A:	
Hectabrite DP	1.75
Klucel J	1.75
Water	40.75
Ethanol	36.75
B:	
Eucalyptus oil	0.20
Menthol	0.40
Peppermint oil	0.40
Triethanolamine	3.00
Methyl salicylate	5.00
Cocoyl sarcosine	10.00
Preservative	q.s.

Phase A: Dry blend Hectabrite DP and Klucel J and add to the water and ethanol slowly, agitating continually until smooth.
Phase B: Combine, stirring to dissolve crystals, and add to Phase A with slow mixing. Mix until uniform.

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HAMPOSYL N-Acyl Sarcosinate Surfactants

In Antiperspirants and Deodorants

HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants have been claimed to enhance the substantivity of antiperspirant actives, such as aluminum chlorohydroxide[1] and have been used in deodorant sticks[2]. A prototype formulation is presented in Table 1.

Table 1: Deodorant Stick

Component	Composition (w/w) %
A:	
VEEGUM	2.0
Water	q.s.
B:	
Zinc stearate	5.0
C:	
Cocoyl sarcosine	2.0
D:	
Pyrax B	90.5
Vancide 89RE	0.5

Add the VEEGUM to about 30 parts water, agitating continually until smooth. Add the zinc stearate with agitation. Add the cocoyl sarcosine to the paste. Premix D, add to A, B and C and work into a smooth paste (add more water if necessary to get a paste). Pack into stick mold and allow to dry. (Final pH should be about 5.0.)

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[1] Technical Data Sheet No. 222, R.T. Vanderbilt Company, Inc., July 1969.
[2] Technical Data Sheet IC552, American Colloid Company, Consumer Specialty Division.

HAMPOSYL N-Acyl Sarcosinate Surfactants

In Aerosol Shave Creams and Depilatories

HAMPOSYL
Surfactants

HAMPOSYL† N-Acyl Sarcosinate Surfactants have been used in aerosol shave creams and depilatories. A prototype formulation is presented in Table 1.

Table 1: Aerosol Shave Cream

Component	Composition (w/w) %
A:	
VEEGUM	1.5
Water	76.0
Sorbitol (70% solution)	3.0
Triethanolamine	6.0
B:	
Stearic acid	6.5
Cocoyl sarcosine	7.0
Preservative	q.s.
Perfume	q.s.

I. Add the VEEGUM to water slowly, agitating continually until smooth. Add sorbitol and triethanolamine. Heat to 70°C.
II. Heat B to 75°C.
III. Add II to I and mix until cool.

Sarcosinate has also been used in aerosol depilatories containing thioglycolic acid[1]. A formulation from the patent is presented in Table 2.

Table 2: Aerosol Depilatory Spray

Component	Composition (w/w) %
Sodium N-lauroyl sarcosinate	1.5
Sodium metasilicate penthydrate	1.0
Thioglycolic acid (80% solution)	7.5
Sodium hydroxide	5.36
Urea	10.0
Perfume	0.45
Water	q.s.

† Trademark of Chattem Chemicals, Inc., An Elcat Company

[1] J.G. Spitzer, L.I. Osipo, M. Small and D.C. Marra, U.S. Patent 4,174,386, November 1979.

HAMPOSYL N-Acyl Sarcosinate Surfactants

In Sunscreens

HAMPOSYL
Surfactants

A HAMPOSYL† N-Acyl Sarcosinate Surfactant (Cocoyl Sarcosine) has been used to enhance the substantivity of actives in sunscreen formulations. A formulation published by R.T. Vanderbilt(1) is presented in Table 1.

Table 1: Sunscreen Lotion

Component	Composition
A:	
VEEGUM	1.5
Water	78.5
Triethanolamine	4.0
B:	
Myvacet 9-40	4.0
Cetyl alcohol	0.5
Stearic acid	1.5
Cocoyl sarcosine	5.0
C:	
P-aminobenzoic acid	5.0

I. Rehydrate VEEGUM in water. Add TEA and heat to 65°C.
II. Heat B to 70°C, then add to I with agitation.
III. Add paba with agitation until 35°C is reached.

This formula effectively screened out ultraviolet light. Part of a subject's forearm was treated with the lotion and part was untreated. The untreated portion received a severe burn, whereas the treated portion received no burn.

† Trademark of Chattem Chemicals, Inc., An Elcat Company

(1) W. Sablowsky and W.F. Kelley, Tech. Data Sheet R356, R.T. Vanderbilt Company, Inc., December 1970.

HAMPOSYL N-Acyl Sarcosinate Surfactants

In Germicidal Products

HAMPOSYL
Surfactants

Germicidal actives such as quaternary ammonium compounds and chlorohexidine gluconate can be formulated with HAMPOSYL† N-Acyl Sarcosinate Surfactants.

A cationic germicidal cleanser which contains cetrimonium chloride along with N-acyl sarcosinate is presented in Table 1.

Table 1: Cationic Skin Cleanser

Component	Composition (w/w) %
Sodium lauroyl sarcosinate, 30%	50.0
Oleoyl sarcosine	1.0
Lauramide DEA	5.0
Tetrasodium EDTA	0.4
Cetrimonium chloride, 29%	3.4
Water	q.s.

Chloroxylenol is a very low toxicity, broad spectrum germicide. It can be formulated with sarcosinates to produce surgical scrubs and wound cleaners. A formulation for a liquid surgical scrub is presented in Table 2.

Table 2: Surgical Scrub Liquid

Component	Composition (w/w) %
Sodium C_{14-16} olefin sulfonate, 40%	20.0
Sodium lauroyl sarcosinate, 30%	10.0
Cocamide MEA	3.0
Chloroxylenol	1.0
Ammonium chloride	2.0
Disodium EDTA	0.2
Water	q.s.

Adjust pH to 5.5.

Many surfactants are unsuitable for cleaning oily skin, since sebum is a potent delathering agent on mild surfactants, and more aggressive surfactants dry the skin excessively and can cause irritation.

Medicated cleansers containing sarcosinates, can reduce the sebum level without causing redness and irritation.

A facial cleanser formulation for oily skin which uses salicylic acid as a keratolytic agent is presented in Table 3.

Table 3: Facial Cleanser for Oily Skin

Component	Composition (w/w) %
TEA lauroyl sarcosinate, 40%	20.0
Hydroxypropylmethyl cellulose, E4000	2.0
Salicylic acid	1.0
Methyl paraben	0.2
EDTA	0.2
Water	q.s.

Dispense thickener in hot water before adding other ingredients.

This formulation produces a rich lather, retains the activity of the salicylic acid and is gentle on the skin.

† Trademark of Chattem Chemicals, Inc., An Elcat Company

Benzoyl peroxide is a useful active for the control of acne, but is difficult to stabilize. The formulation for an acne scrub gel, presented in Table 4, is stable with respect to peroxide activity and forms rich creamy lather.

Table 4: Acne Lather Scrub Gel with 10% Benzoyl Peroxide

Component	Composition (w/w) %
Sodium lauroyl sarcosinate, 30%	30.0
Oleth-10	15.0
Benzoyl peroxide, 70%	14.3
Magnesium aluminum silicate (Veegum – R.T. Vanderbilt Co.)	1.0
Disodium EDTA	0.2
Water	q.s.

Disperse Veegum in hot water with high shear mixing and allow to stand overnight. Mill benzoyl peroxide with Veegum suspension. Mix remaining ingredients, heat to 50°C and mill to uniform texture. Fill warm into containers. A stiffer gel may be obtained by increasing the oleth-10 to 20.0%.

Novel topical coal tar gel formulations that contain acyl sarcosine and are useful for the treatment for skin disorders such as dermatitis, especially psoriasis and eczema, have been developed by Klein and Foxx[1]. A formulation from their patent is presented in Table 5.

Table 5: Emollient Gel

Component	Composition
Coal tar extract	50 mg
N-lauroyl sarcosine	30 mg
Glyceryl capric/caprylic ester	800 mg
Propylene glycol	20 mg
Glyceryl tris 12-hydroxy stearate	100 mg

[1] R.E. Klein and M.E. Foxx, U.S. Patent 4,178,373, Assigned to William H. Rorer, Inc., December 1979.

3708 St Elmo Avenue, Chattanooga, TN 37409, Telephone: 423-822-5000 Fax: 423-825-0507

Alternatively, the desired amount of fatty acid and co-surfactant can be added to the N-acyl sarcosine, with subsequent neutralization of the acid mixture with the appropriate amount of base, as described in Example 3 and 4.

Example 3: Production of a Combination Soap Bars Using Cocoyl Sarcosine, Fatty Acid and Base

1. 20 grams cocoyl sarcosine.
2. 20 grams stearic acid or 15 grams stearic and 5 grams lauric acid.
3. 3 grams NaOH pellets or 6 grams 50% NaOH. Adjust pH to 6-7.
4. Pour liquid into molds and allow to set.

Note: Lauric/stearic combination produces more foam. Product may be remelted.

Example 4: Production of a Combination Soap Bars Using Lauroyl Sarcosine, Fatty Acid and Base

1. 20 grams lauroyl sarcosine.
2. 20 grams stearic acid.
3. 20 grams Na cocoyl isethionate.
4. 5 grams 50% caustic. Adjust pH to 6-7.
5. Pour liquid into molds and allow to set.

Procedure for Examples 3 and 4

1. Heat N-acyl sarcosine to 55°C.
2. Dissolve fatty acid.
3. Add co-surfactants if desired.
4. Neutralize pH to 6-7 with base (e.g., NaOH, KOH, TEA).
5. Pour liquid into molds and allow to set.

Note: Product is remeltable and may be processed by conventional techniques.

The process produces a good solid bar, which provides strong and gentle detergency and an elegant skin feel.

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