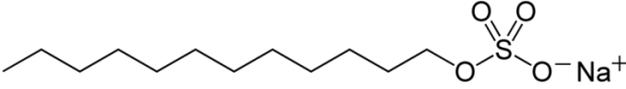
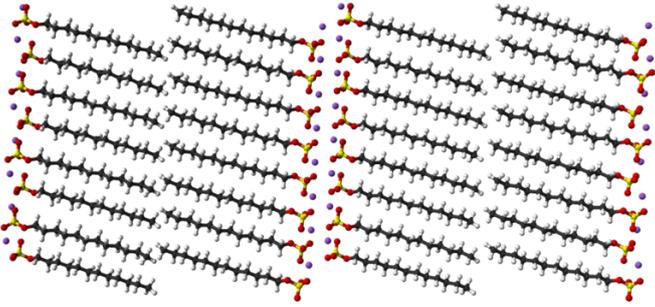


# Sodium lauryl sulfate

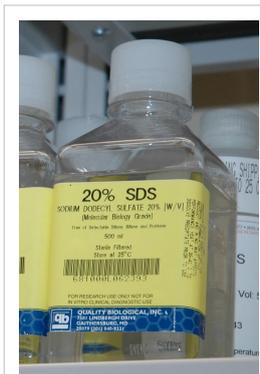
Sodium dodecyl sulfate	
	
	
Identifiers	
CAS number	151-21-3 <sup>[1]</sup> ✓
ATC code	A06 AG11 <sup>[2]</sup>
Properties	
Molecular formula	$\text{NaC}_{12}\text{H}_{25}\text{SO}_4$
Molar mass	288.38 g mol <sup>-1</sup>
Density	1.01 g/cm <sup>3</sup>
Melting point	206 °C
✓ (what is this?) (verify) <sup>[3]</sup> Except where noted otherwise, data are given for materials in their standard state (at 25 °C, 100 kPa)	
Infobox references	

**Sodium lauryl sulfate (SLS)**, **sodium laurilsulfate** or **sodium dodecyl sulfate (SDS or NaDS)** ( $\text{C}_{12}\text{H}_{25}\text{SO}_4\text{Na}$ ) is an anionic surfactant used in many cleaning and hygiene products. The molecule has a tail of 12 carbon atoms, attached to a sulfate group, giving the molecule the amphiphilic properties required of a detergent.

SLS is a highly effective surfactant and is used in any task requiring the removal of oily stains and residues. For example, it is found in higher concentrations with industrial products including engine degreasers, floor cleaners, and car wash soaps. It is used in lower concentrations with toothpastes, shampoos, and shaving foams. It is an important component in bubble bath formulations for its thickening effect and its ability to create a lather.

Research showed that SLS is not carcinogenic when either applied directly to skin or consumed.<sup>[4]</sup> It has however been shown to irritate the skin of the face with prolonged and constant exposure (more than an hour) in young adults.<sup>[5]</sup> A clinical study found SLS toothpaste caused a higher frequency of aphthous ulcers than both cocoamidopropyl betaine or a detergent-free paste, on 30 patients with frequent occurrences of such ulcers.<sup>[6]</sup> A clinical study comparing toothpastes with and without SLS found that it had no significant effect on ulcer patterns.<sup>[7]</sup>

## Applications



Bottle of sodium dodecyl sulfate for use in the laboratory.

SLS is a highly effective surfactant and is used in any task requiring the removal of oily stains and residues. As such the compound is found in high concentrations in industrial products including engine degreasers, floor cleaners, and car wash soaps. In household products, SLS is used in lower concentrations with toothpastes, shampoos, and shaving foams. It is an important component in bubble bath formulations for its thickening effect and its ability to create a lather.

Sodium lauryl sulfate diminishes perception of sweetness<sup>[8]</sup>, an effect commonly observed after recent use of toothpaste containing this ingredient<sup>[9]</sup>.

Research suggests that SLS could represent a potentially effective topical microbicide, which can also inhibit and possibly prevent infection by various enveloped and non-enveloped viruses such as the Herpes simplex viruses, HIV, and the Semliki Forest Virus.<sup>[10] [11]</sup>

It has recently found application as a surfactant in gas hydrate or methane hydrate formation reactions, increasing the rate of formation as much as 700 times.<sup>[12]</sup>

In medicine, sodium lauryl sulfate is used rectally as a laxative in enemas, and as an excipient on some dissolvable aspirins and other fiber therapy caplets.

It can be used to aid in lysing cells during DNA extraction and for unraveling proteins in SDS-PAGE. Sodium lauryl sulfate, in science referred to as sodium *dodecyl* sulfate (SDS) or Duponol, is commonly used in preparing proteins for electrophoresis in the SDS-PAGE technique.<sup>[13]</sup> This compound works by disrupting non-covalent bonds in the proteins, denaturing them, and causing the molecules to lose their native shape (conformation).

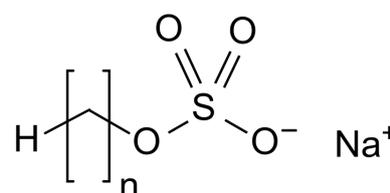
This new negative charge is significantly greater than the original charge of that protein. The electrostatic repulsion that is created by binding of SDS causes proteins to unfold into a rod-like shape thereby eliminating differences in shape as a factor for separation in the gel. Sodium lauryl sulfate is probably the most researched anionic surfactant compound. Like all detergent surfactants (including soaps), sodium lauryl sulfate removes oils from the skin, and can cause skin and eye irritation. The critical micelle concentration (CMC) in pure water at 25°C is 0.0082 M,<sup>[14]</sup> and the aggregation number at this concentration is usually considered to be about 62.<sup>[15]</sup> The micelle ionization fraction ( $\alpha$ ) is around 0.3 (or 30%).<sup>[16]</sup>

There is evidence that surfactants such as sodium lauryl sulfate can act as a shark repellent at concentrations on the order of 100 parts per million. However, this does not meet the desired "cloud" deterrence level of 0.1 parts per million.<sup>[17] [18]</sup>

## Synthesis

SLS is synthesized by reacting lauryl alcohol with sulfuric acid to produce hydrogen lauryl sulfate which is then neutralized through the addition of sodium carbonate.<sup>[19]</sup> Lauryl alcohol is in turn usually derived from either coconut or palm kernel oil by hydrolysis, which liberates their fatty acids, followed by reduction of the acid group to an alcohol.

Due to this synthesis method, commercially available SLS is actually not pure dodecyl sulfate but a mixture of alkyl sulfates with dodecyl sulfate as the main component.<sup>[20]</sup>



The structure of SLS:  $C_nH_{2n+1}SO_4Na$  ( $n \approx 12$ )

## Toxicology

### Cancer

The available evidence does not show that SLS is carcinogenic, either when applied directly to the skin or consumed.<sup>[4]</sup> According to a review of the scientific literature, "SLS was negative in an Ames (bacterial mutation) test, a gene mutation and sister chromatid exchange test in mammalian cells, as well as in an in vivo micronucleus assay in mice. The negative results from in vitro and in vivo studies indicate SLS does not interact with DNA."<sup>[21]</sup>

### Sensitivity

SLS may worsen skin problems in individuals with chronic skin hypersensitivity, with some people being affected more than others.<sup>[22] [23] [24]</sup> SLS has also been shown to irritate the skin of the face with prolonged and constant exposure (more than an hour) in young adults.<sup>[5]</sup> In animal studies SLS appears to cause skin and eye irritation.<sup>[21]</sup>

### Aphthous ulcers

A preliminary study suggested SLS in toothpaste caused the recurrence of aphthous ulcers, commonly referred to in some countries as canker sores or white sores.<sup>[25]</sup> The preliminary study "showed a statistically significant decrease in the number of aphthous ulcers from 14.3 after using the SLS-containing dentifrice to 5.1 ulcers after brushing with the SLS-free dentifrice."<sup>[25]</sup> A clinical study comparing the incidence of recurrent aphthous ulcers during the use of dentifrices with and without sodium lauryl sulfate supported the findings of an earlier independent study which suggest that use of an SLS-free dentifrice should be considered for individuals who suffer from recurrent aphthous ulcers.<sup>[26]</sup> A clinical double-blind crossover study found sodium lauryl sulfate had a significantly higher frequency of aphthous ulcers than both cocoamidopropyl betaine or a detergent-free paste, on 30 patients with frequent occurrences of recurrent aphthous ulcers.<sup>[6]</sup> The clinical double-blind crossover study suggests use of an SLS-free toothpaste for patients with recurrent aphthous ulcers would reduce recurrence.<sup>[6]</sup> A double-blind crossover trial comparing toothpastes with and without SLS found that it had no significant effect on ulcer patterns.<sup>[7]</sup>

### See also

- Ammonium lauryl sulfate
- Sodium myreth sulfate

## References

- [1] <http://www.commonchemistry.org/ChemicalDetail.aspx?ref=151-21-3>
- [2] [http://www.whocc.no/atc\\_ddd\\_index/?code=A06AG11](http://www.whocc.no/atc_ddd_index/?code=A06AG11)
- [3] [http://en.wikipedia.org/wiki/%3Asodium\\_lauryl\\_sulfate](http://en.wikipedia.org/wiki/%3Asodium_lauryl_sulfate)
- [4] CIR publication (1983). "Final Report on the Safety Assessment of Sodium Lauryl Sulfate and Ammonium Lauryl Sulfate". *International Journal of Toxicology* **2** (7): 127–181. doi:10.3109/10915818309142005..
- [5] Marrakchi S, Maibach HI (2006). "Sodium lauryl sulfate-induced irritation in the human face: regional and age-related differences". *Skin Pharmacol Physiol* **19** (3): 177–80. doi:10.1159/000093112. PMID 16679819.
- [6] Herlofson BB, Barkvoll P (June 1996). "The effect of two toothpaste detergents on the frequency of recurrent aphthous ulcers". *Acta Odontol. Scand.* **54** (3): 150–3. doi:10.3109/00016359609003515. PMID 8811135.
- [7] Healy CM, Paterson M, Joyston-Bechal S, Williams DM, Thornhill MH (1999 Jan). "The effect of a sodium lauryl sulfate-free dentifrice on patients with recurrent oral ulceration". *Oral Dis.* **5** (1): 39–43. doi:10.1111/j.1601-0825.1999.tb00062.x. PMID 10218040.
- [8] Adams, Michael J. *Characterization and Measurement of Flavor Compounds: Substances That Modify the Perception of Sweetness*. ACS Publications, 1985, p.11-25. Abstract online at <http://pubs.acs.org/doi/abs/10.1021/bk-1985-0289.ch002>
- [9] Clark, Josh. "Why does orange juice taste bad after you brush your teeth?" *Discovery Health*. <http://health.howstuffworks.com/wellness/beauty-hygiene/orange-juice-toothpaste.htm>
- [10] Piret J, Désormeaux A, Bergeron MG. (2002). "Sodium lauryl sulfate, a microbicide effective against enveloped and nonenveloped viruses.". *Curr Drug Targets* **3** (1): 17–30. doi:10.2174/1389450023348037. PMID 11899262.

- [11] Piret J, Lamontagne J, Bestman-Smith J, Roy S, Gourde P, Désormeaux A, Omar RF, Juhász J, Bergeron MG. (2000). "In vitro and in vivo evaluations of sodium lauryl sulfate and dextran sulfate as microbicides against herpes simplex and human immunodeficiency viruses." (<http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pmcentrez&artid=86033>). *J Clin Microbiol* **38** (1): 110–9. PMID 10618073. PMC 86033.
- [12] Watanabe K, Imai S, Mori YH (September 2005). "Surfactant effects on hydrate formation in an unstirred gas/liquid system: An experimental study using HFC-32 and sodium dodecyl sulfate.". *Chemical Engineering Science* **60** (17): 4846–4857. doi:10.1016/j.ces.2005.03.043.
- [13] The acronym expands to "sodium dodecyl sulfate-polyacrylamide gel electrophoresis.
- [14] P. Mukerjee and K. J. Mysels, "Critical Micelle Concentration of Aqueous Surfactant Systems", NSRDS-NBS 36, US. Government Printing Office, Washington, D.C., 1971.
- [15] N.J. Turro. A. Yekta, *J. Am. Chem. Soc.*, 1978, 100, 5951
- [16] Barney L. Bales, Luis Messina, Arwen Vidal, Miroslav Peric, and Otaciro Rangel Nascimento (1998). "Precision Relative Aggregation Number Determinations of SDS Micelles Using a Spin Probe. A Model of Micelle Surface Hydration". *J. Phys. Chem. B* **102** (50): 10347–10358. doi:10.1021/jp983364a.
- [17] Joseph A. Sisneros and Donald R. Nelson. "The effectiveness of sodium lauryl sulphate as a shark repellent in a laboratory test situation" (<http://onlinelibrary.wiley.com/doi/10.1111/j.1095-8649.1991.tb03096.x/abstract>). Retrieved 2010-8-27.
- [18] Larry J. Smith Jr.. "Surfactants as Chemical Shark Repellents: Past, Present, and Future" (<http://www.springerlink.com/content/h513358253p86164/>). Retrieved 2010-8-27.
- [19] *SODIUM LAURYL SULFATE* (<http://chemicaland21.com/specialtychem/perchem/SODIUM LAURYL SULFATE.htm>). Chemical Land21.
- [20] European Pharmacopoeia: Sodium laurilsulfate ([http://lib.njutcm.edu.cn/yaodian/ep/EP5.0/16\\_monographs/monographs\\_q-z/Sodium\\_laurilsulfate.pdf](http://lib.njutcm.edu.cn/yaodian/ep/EP5.0/16_monographs/monographs_q-z/Sodium_laurilsulfate.pdf))
- [21] NICNAS - Sodium Lauryl Sulfate ([http://www.nicnas.gov.au/Publications/Information\\_Sheets/Existing\\_Chemical\\_Information\\_Sheets/ECIS\\_SLS\\_PDF.pdf](http://www.nicnas.gov.au/Publications/Information_Sheets/Existing_Chemical_Information_Sheets/ECIS_SLS_PDF.pdf))
- [22] Agner T (1991). "Susceptibility of atopic dermatitis patients to irritant dermatitis caused by sodium lauryl sulphate". *Acta Derm. Venereol.* **71** (4): 296–300. PMID 1681644.
- [23] Nassif A, Chan SC, Storrs FJ, Hanifin JM (November 1994). "Abnormal skin irritancy in atopic dermatitis and in atopy without dermatitis". *Arch Dermatol* **130** (11): 1402–7. doi:10.1001/archderm.130.11.1402. PMID 7979441.
- [24] Löffler H, Effendy I (May 1999). "Skin susceptibility of atopic individuals". *Contact Derm.* **40** (5): 239–42. doi:10.1111/j.1600-0536.1999.tb06056.x. PMID 10344477.
- [25] Herlofson BB, Barkvoll P (October 1994). "Sodium lauryl sulfate and recurrent aphthous ulcers. A preliminary study". *Acta Odontol. Scand.* **52** (5): 257–9. doi:10.3109/00016359409029036. PMID 7825393.
- [26] Chahine L, Sempson N, Wagoner C (December 1997). "The effect of sodium lauryl sulfate on recurrent aphthous ulcers: a clinical study". *Compend Contin Educ Dent* **18** (12): 1238–40. PMID 9656847.

## External links

- Urban Legends Reference Pages: Shampoo Sham, snopes.com (<http://www.snopes.com/inboxer/household/shampoo.asp>)
- Household Products Database of products containing sodium lauryl sulfate (<http://hpd.nlm.nih.gov/cgi-bin/household/brands?tbl=chem&id=204&query=sodium+lauryl+sulfate&searchas=TblChemicals>)
- Should toothpastes foam? Sodium lauryl sulfate--a toothpaste detergent in focus. (<http://www.ncbi.nlm.nih.gov/pubmed/2696932>)

# Article Sources and Contributors

**Sodium lauryl sulfate** *Source:* <http://en.wikipedia.org/w/index.php?oldid=397524797> *Contributors:* AManWithNoPlan, Anypodetos, Arcadian, Arcayne, Ataranlen, Azweifel, Babbage, Bairam, Bender235, Benjah-bmm27, Bensaccount, BeteNoir, Bfigura, Brijbhansinghyadav, Campoftheamericas, Causa sui, Cavalry, Centrx, Cfrowpar, Chem-awb, Cybercobra, DFS454, Daniel Leavitt, Desertsy85451, Dr. Crash, Dulciana, E. Sn0 =31337=, Edgar181, Electron9, Element16, Eras-mus, Eveningmist, Everyking, FK1954, Fvasconcellos, Gabbe, Gaberdine2, Glen, Graham87, Gwernol, Hede2000, Herbal Lemon, Heron, Iqu, Isaac Dupree, Itai, Janoub, Jeppelbaum, Joshua P. Schroeder, Jrockley, Jujutacular, Jynx980, K11ted, Kan.huang, Keenan Pepper, KingCuongL, Kingdon, Km203, Landisdesign, Lark ascending, LeadSongDog, Leyo, Longbowman, Maddyloise96, Madi21, Magnus Manske, Malcolm Farmer, Mav, Michał Sobkowski, Michi zh, Mokgen, MotherAmy, NawlinWiki, Nehulinusa, Oaktree b, PSimeon, Panfily, Patricknorman, Pizza1512, Pyrochem, Quirkie, Rifleman 82, Rk6036, Rodolph, Sakkura, Sean Whitton, Seekerjustice, Shaddack, Sjschen, Supernatent, Techbert, Tedder, Teeteete, TenOfAllTrades, Tntdj, Uvaduck, Viridae, Vsmith, WaysToEscape, Wjhonson, Zilch0000, Zombielouhltz, Αρετιμς, لی‌ق‌ع ف‌ش‌اک, 142 anonymous edits

# Image Sources, Licenses and Contributors

**Image:SDS-2D-skeletal.png** *Source:* <http://en.wikipedia.org/w/index.php?title=File:SDS-2D-skeletal.png> *License:* Public Domain *Contributors:* Bender235, Benjah-bmm27, Cwbn (commons), Rifleman 82

**Image:SDS-sheet-3D-balls.png** *Source:* <http://en.wikipedia.org/w/index.php?title=File:SDS-sheet-3D-balls.png> *License:* Public Domain *Contributors:* Ben Mills

**File:Yes check.svg** *Source:* [http://en.wikipedia.org/w/index.php?title=File:Yes\\_check.svg](http://en.wikipedia.org/w/index.php?title=File:Yes_check.svg) *License:* Public Domain *Contributors:* User:Gmaxwell, User:WarX

**File:Sodium dodecyl sulfate.jpg** *Source:* [http://en.wikipedia.org/w/index.php?title=File:Sodium\\_dodecyl\\_sulfate.jpg](http://en.wikipedia.org/w/index.php?title=File:Sodium_dodecyl_sulfate.jpg) *License:* unknown *Contributors:* Diane A. Reid, Photographer

**File:Sodium alkyl sulfates structure.svg** *Source:* [http://en.wikipedia.org/w/index.php?title=File:Sodium\\_alkyl\\_sulfates\\_structure.svg](http://en.wikipedia.org/w/index.php?title=File:Sodium_alkyl_sulfates_structure.svg) *License:* Public Domain *Contributors:* User:Anypodetos

# License

---

Creative Commons Attribution-Share Alike 3.0 Unported  
<http://creativecommons.org/licenses/by-sa/3.0/>