

What is a surfactant?

A surfactant is a material that possesses the ability to radically alter the free energy of a liquid surface or interface when present in the system at low concentrations. The word “surfactant” is a contraction of the term “surface active agent.”

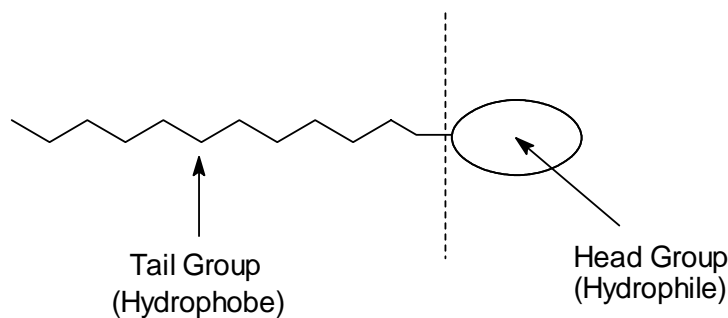
Are there other names for surfactants?

Depending on the end use of the surfactant, a number of functional names can be used. Some pseudonyms for surfactants are:

Wetting Agents	Soaps
Emulsifiers	Detergents
Demulsifiers	Solubilizers
Dispersants	Tensides (German)
Foam Boosters	Defoamers

What is the structure of a surfactant?

A surfactant molecule comprises two distinct portions: a water-loving (hydrophilic) head group which can be compact (anionic) or diffuse (some nonionics) and a diffuse, oil-loving (lipophilic) tail group. In the literature, a generic surfactant molecule is often represented as a “tadpole.”

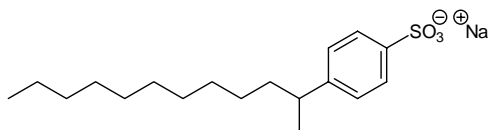


What types of surfactant are there?

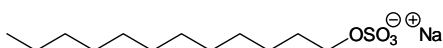
There are four types of surfactant: anionic, nonionic, amphoteric and cationic. Of these four types, Pilot sells examples of the first three.

a) Anionics: Anionic surfactants are characterized by having a negatively charged head group. Examples are sulfates and sulfonates such as sodium lauryl sulfate (SLS) or sodium dodecylbenzene sulfonate (NaLAS).

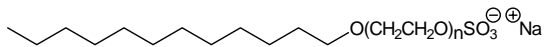
The majority of Pilot's products are anionic surfactants: the Aristonate series; the Calfoam SLS, ALS, ES, and EA series; the Calsoft F, P, L and AOS series; the Calimulse SLS, AOS and EM series and the Calfax series of disulfonates.



Sodium Dodecylbenzene Sulfonate
(2-Phenyl Isomer Shown)

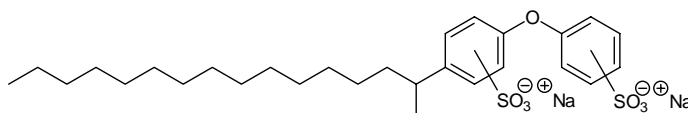


Sodium Lauryl Sulfate



Sodium Lauryl Ether (or Laureth) Sulfate

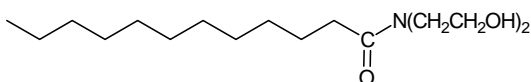
(Note: for "2-mole" ES, n = an average of 2)



Alkyl Diphenyl Oxide Disulfonate
(Shown: linear C₁₆ - as in Calfax 16L-35)

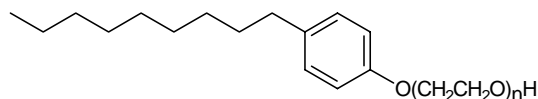
Other anionics include phosphates, carboxylates, sulfosuccinates, taurates and isethionates.

b) Nonionics: Nonionics are characterized by having an uncharged head group. The most common examples of this type are the alkylphenol ethoxylates (Caloxylate N-9) and ethoxylated alcohols. Pilot's leading products in this group are the Calamide line of alkanolamides.



Lauramide DEA -

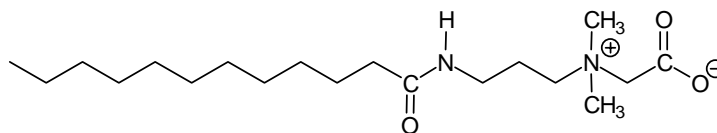
the predominant component of Calamide C



A Nonylphenol Ethoxylate (Caloxylate N-9)

Fatty acid esters and alkylpolyglycosides (APG's) comprise other species of nonionics.

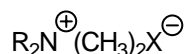
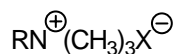
c) Amphoterics (or Zwitterionics): Amphoterics exhibit a head group which possesses both a positive and a negative charge i.e. a "Zwitterionic" head group. An example of a Pilot product in this group is Caltaine C-35 (Cocamidopropyl betaine).



Cocamidopropyl Betaine

Amine oxides are another example of amphoteric surfactants.

d) Cationics: Cationic surfactants contain a positively charged head group. The most common examples of these are the quaternary ammonium salts.



(R = long chain alkyl, benzyl or methyl (2° only) group
X = Cl, Br, etc.)

Note: Cationics are outside Pilot's current product line.