

# Principles of formulation and building blocks of Hair care products: Shampoo

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# Introduction: Definition

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A shampoo is a preparation of a surfactant(i.e. surfaceactive material) in a suitable form – liquid, solid or powder – which when used under the specified conditions will remove surface grease, dirt, and skin debris from the hair shaft and scalp without adversely affecting the user

# Shampoos are needed..

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1. Completely remove dirt
2. Protect the hair
3. Soothe the scalp skin
4. Treat dandruff, lice or other scalp problems

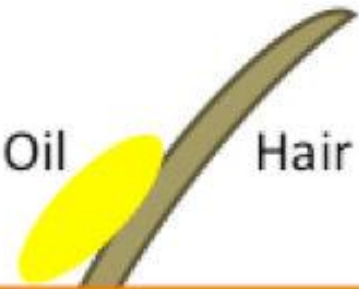

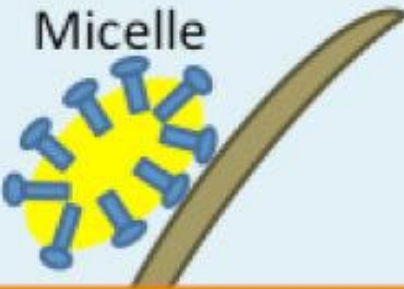

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Surfactants are the main component of shampoo. Mainly anionic surfactants are used.

The raw materials used in the manufacture of shampoos are:

1. Principal surfactants: Provide detergency and foam.
2. Secondary surfactants: Improve detergency, foam and hair condition.
3. Other additives.

# Working of Shampoos

Before	Shampooing	Mode of Action	Rinse
 <p>Oil is shown as a yellow oval attached to a brown hair strand. The word "Oil" is to the left and "Hair" is to the right.</p>	 <p>Surfactant molecules, represented as blue T-shaped structures, are shown attaching to the yellow oil on the hair strand. The word "Surfactant" is written above the molecules.</p>	 <p>A micelle is shown as a spherical cluster of surfactant molecules with their hydrophobic tails pointing inward and hydrophilic heads pointing outward. The word "Micelle" is written above it.</p>	 <p>The micelle is shown being washed away from the hair strand into a blue background representing water.</p>
Skin	Skin	Skin	Skin
Oil and dirt are attached to the skin and hair	The surfactant lowers the surface tension of the water	The surfactant creates micelles around the dirt and oil that are removed from the skin and hair	The micelles with the oil, dirt and surfactant are eliminated with the water during rinse

# Requirements of a Shampoo:

- 1.It should effectively and completely remove dust or soil, excessive sebum or other fatty substances and loose corneal cells from the hair.
- 2.It should produce a good amount of foam to satisfy the psychological requirements of the user.
- 3.It should be easily removed on rinsing with water.
- 4.It should leave the hair non-dry, soft, lustrous with good manageability and minimum fly away.
- 5.It should impart a pleasant fragrance to the hair.
- 6.It should not cause any side-effects / irritation to skin or eye.
- 7.It should not make the hand rough and chapped.

# Shampoo Types

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Powder Shampoo

Liquid Shampoo

Lotion Shampoo

Cream Shampoo

Jelly Shampoo

Aerosol Shampoo

Specialized Shampoo

- Conditioning Shampoo
- •Anti- dandruff Shampoo•
- Baby Shampoo
- •Two Layer Shampoo

# Shampoo: ADDITIVES

**Conditioning agents:** Lanolin, mineral oil, herbal extracts, egg derivatives.

**Foambuilders:** Lauroylmonoethanolamide, sarcosinates

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- **Viscosity modifiers :** Electrolytes –NH<sub>4</sub>Cl, NaCl
- Natural gums –Gum Karaya, tragacanth, alginates
- Cellulose derivatives –Hydroxyethyl cellulose, methyl cellulose
- Carboxyvinyl polymers –Carbopol934
- Others –PVP, phosphate esters.

**Sequestering agents :** EDTA

**Opacifying agents:** Alkanolamides of higher fatty acids, propylene glycol, Mg, Ca and Zn salts of stearic acid, spermaceti, etc.

**Clarifying agents:** Solubilizing alcohols –ethanol, isopropanol Phosphates –

- Non-ionic solubilizers –polyethoxyated alcohols and esters.



# Shampoo: ADDITIVES

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**Perfumes:** Herbal, fruity or floral fragrances.

**Preservatives:** Methyl and propylparaben, formaldehyde (*most effective*).

**Anti-dandruff agents:** The shampoos contain small amount of the seactives, which are in contact with the scalp for only a short time. In order to be effective the active ingredient must work in the oil-water environment of the scalp and must be readily substantive to the scalp for continuing activity.

Ex: Selenium sulfide, zinc pyrithone, salicylic acid.

# Formulation Ingredients: Water

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This is the main ingredient in all shampoo preparations, comprising about 60-80% of the solution.

It aids in diluting the cleaning agents, thereby reducing irritation.

It makes the shampoo formula easier to spread on the hair and scalp.

# Formulation Ingredients: Surfactants

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Surfactants form the 'heart' of most shampoo formulations

Surfactants are compounds that lower the interfacial tension of a between two phases.

These are molecules that possess both hydrophilic and lipophilic moieties in their structure. they get adsorbed on the interface and helps the phases to miscibilize.

1. Principal surfactants: Provide detergency and foam.
2. Secondary surfactants: Improve detergency, foam and hair condition.

# Formulation Ingredients: Surfactants

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**Anionic surfactants** are mostly used (good foaming properties). The hydrophilic portion carries a negative charge which results in superior foaming, cleaning and end result attributes.

**Non-ionic surfactants** have good cleansing properties but do not have sufficient foaming power.

**Cationic surfactants** are toxic and are hence not used. However, they may be used in low concentration in hair conditioners.

- **Ampholytics**, being expensive, are generally not used. However, they are mainly used as secondary surfactants and good hair conditioners.

# Formulation Ingredients: Surfactants

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Sodium Lauryl Sulfate (SLS) and Sodium Lauryl Ether Sulfate (SLES) play similar role in shampoos.

SLS is a skin, eye and respiratory tract irritant (**inherently toxic to aquatic organisms**).

To make it less irritating, it is ethoxylated (by adding ethylene oxide), resulting in SLES.

# Formulation Ingredients: Foaming Agents

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These agents are used to introduce gas bubbles into the water. The foam, also known as lather, is important, as it functions to spread the detergent over the hair and scalp, but it does not participate in cleaning.

It is true that a shampoo applied to dirty hair will not foam as much as the same shampoo applied to clean hair. This is due to the sebum inhibiting bubble formation. Thus, a shampoo will foam less on the first shampooing and more on the second shampooing.

Some of the prescription corticosteroid shampoos do not foam as much as cosmetic shampoos, but this does not mean their cleaning is inadequate.

Examples: Lauroyl monoethanolamide, sarcosinates

# Formulation Ingredients: Sequestering Agents

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These are the agents to chelate magnesium and calcium ions, present in hard water preventing formation of insoluble soaps (scum).

This scum film will make hairs look dull and may contribute to itching and symptoms of seborrheic dermatitis.

Eg:EDTA

# Formulation Ingredients:pH Adjusters

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These agents are used to prevent the hair shaft from alkalinisation.

Most detergents are having alkaline pH, which causes hair shaft swelling.

This swelling loosens the protective cuticle predisposing the hair shaft to damage.

Example: Citric acid, Glycollic acid



# Formulation Ingredients: Thickening Agents

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These agents are used shampoo thick and creamy. Thickening may be achieved by adding salts or gums.

Gums improve viscosity because of their gel-like properties.

Eg: Tragacanth gum, Gum Karaya, Carboxy methyl cellulose.

# Formulation Ingredients: Thickening Agents

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## **How salt act as thickening agent for shampoos containing anionic surfactant??**

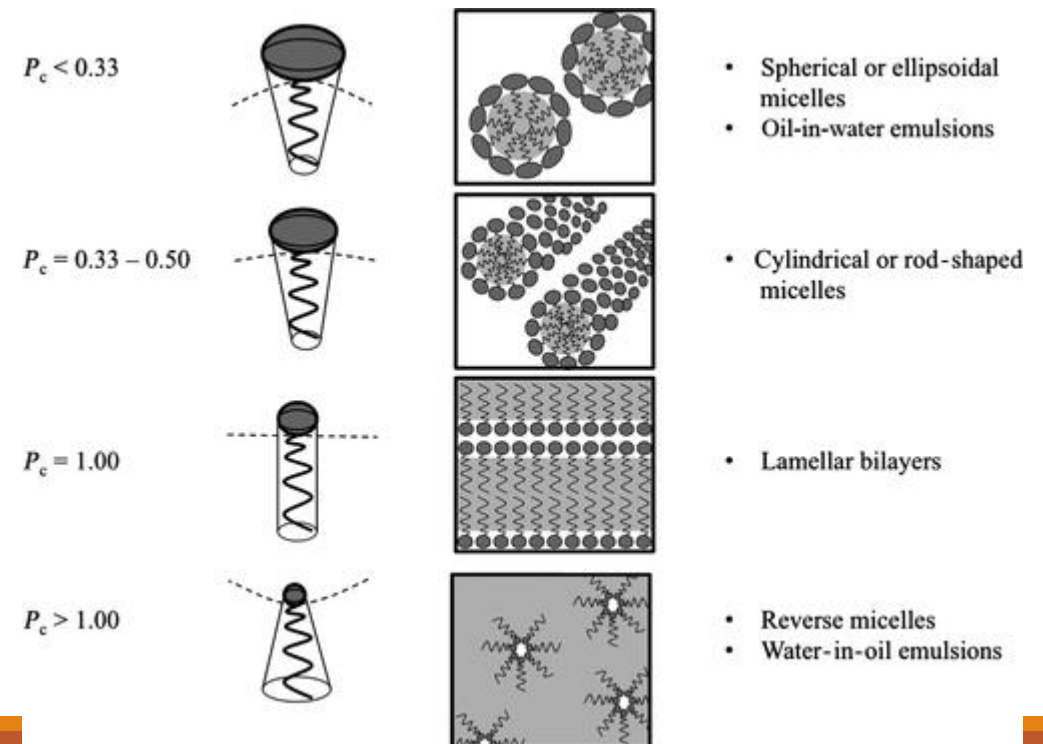
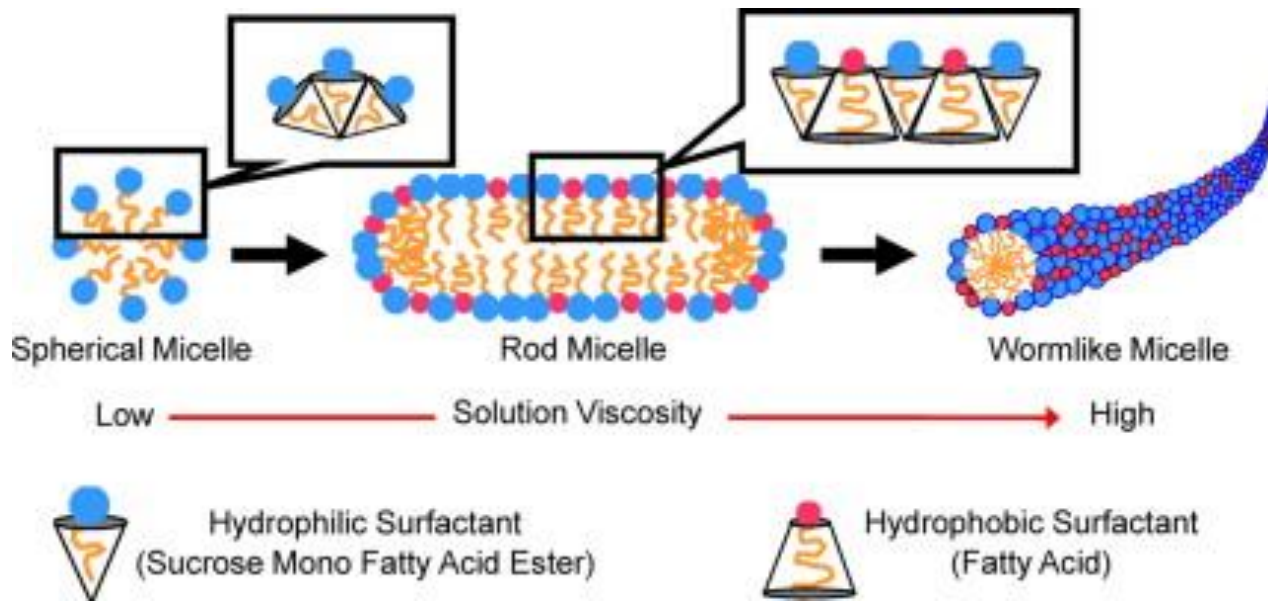
The viscosity of the shampoo solution depends on the size and packing structure of micelles (tiny vesicles of surfactants).

In general, higher charge density causes the micelles to repel and result in a thinner solution.

The sodium ions from the salt lower the charge density of the micelle surface.

This makes them more able to pack closer together and creates a thicker solution.

the way the surfactants pack together and form three-dimensional structures in the product will decide the rheology of a shampoo



# Formulation Ingredients: Opacifying Agents

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Chemical agents added to the preparation to make it opaque, so that light does not pass through.

These are usually added to give pearly shine, which offers no improved cleansing.

It provides only optical effect.

Eg: Spermaceti, Alkanolamides of higher fatty acids, propylene glycol, Mg, Ca and Zn salts of stearic acid etc

# Formulation Ingredients: Conditioners

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The conditioner functions to impart manageability, gloss, and antistatic properties to the hair.

These are usually fatty alcohols, fatty esters, vegetable oils, mineral oils, or humectants.

Commonly used conditioning substances include hydrolyzed animal protein, glycerin, dimethicone, simethicone, polyvinylpyrrolidone, propylene glycol etc.

Protein-derived substances are popular conditioners for damaged hair, as they can temporarily mend split ends.

Split ends arise when the protective cuticle has been lost from the distal hair shaft and the exposed cortex splits.

The protein derived substances holds the cortex fragments together until the next shampooing occurs.

# Formulation Ingredients: **Perfumes**

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Shampoos include perfumes that are mostly concentrated.

Example: Fruit fragrance