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Shampoo and Conditioners: What a Dermatologist Should Know?

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Abstract

Dermatologists many a times encounter questions from patients and even colleagues asking about how to keep their hair looking clean, healthy and beautiful. Therefore, familiarity and a basic knowledge of the available hair care products will help them to guide their patients properly. A shampoo not only provides the cleaning of the scalp skin and hair as its primary function, but in addition also serves to condition and beautify hair and acts as an adjunct in the management of various scalp disorders. To achieve this, various ingredients in the correct proportion are mixed to provide a shampoo which is suitable for individuals having different hair types and hair need. Among the ingredients that go into the making of a shampoo are detergents, conditioners, thickeners, sequestering agents, pH adjusters, preservatives and specialty additives. Hair conditioners are designed to improve hair manageability, decrease hair static electricity and add luster. They are used in several ways depending upon the state of hair and requirement of the individual. This article attempts to put forward the basic and practical aspects regarding use of these products.

Keywords: *Conditioner, hair, shampoo*

What was known?

- Hair shampoo is a hair care product comprising among other things of synthetic detergents designed to remove sebum and environmental dirt.
- Hair conditioners aid to improve hair manageability.

Introduction

Having good looking hair and skin is the need of the hour, both being a part and parcel of our personality. The value of the treasure sitting on our heads is appreciated deeply by those who start losing it due to various causes of hair loss. Maintenance and grooming of hair is a daily routine for most of the people and it is not uncommon to see people investing a huge amount of time and money on hair care, which has created a huge industry selling lots of hair care products to fulfill the demand. India too is undergoing a hair revolution with markets flooded with products promising instant beautification of hair.

What makes for a healthy hair?

Healthy hair looks clean, soft to feel, shiny, untangled, has no frizz and is bouncy when shaking the head. To have this, you require not only a good overall health and freedom from disease but a daily chore of maintenance and grooming of hair. For a smooth, wet and dry feel, friction between hair and skin should be minimized in wet and dry environment, respectively, and if you desire a good feel with respect to bouncing and shaking of the hair during walking and running, friction low between hair fibers.[\[1\]](#) Shampoos and conditioners of today target some of the factors responsible for helping the hair look healthy through their various ingredients.

Why a dermatologist need to know about hair cleansing products?

Dermatologists many a times encounter patients with or without hair disorders asking many questions about how to keep hair looking clean and beautiful. Which shampoo or conditioner must I use for my kind of hair? is the most common query of most patients. Familiarity with available hair care products along with a basic knowledge of the different types of hair seen in individuals will help doctors to offer expert advice and prevent awkward moments in clinical practice. This article in brief would be discussing the basic and practical aspects regarding cosmetic shampoo and conditioners relevant to a dermatologist. Therefore, therapeutic shampoo will not be discussed here.

Shampoo

Shampoo in simple terms is a hair care product designed to clean the scalp skin along with its hairs. Incidentally, the term shampoo entered the English language through India where the Hindi word “champoo” was used meaning to press or massage; it was used to denote cleaning through massage of the hair and skin.[2] Cleaning the hair has always been a tough task especially for women. An average western woman has 4-8 square meters of hair.[3] This will probably be more for the average Indian women due to culture of keeping long hair. Traditional soaps which were used earlier for both skin and scalp are not recommended anymore for hair cleaning as they don't have good lathering capability and leave behind “soap scum” when mixed with hard water which is difficult to rinse off. Modern shampoo as it is known today was first introduced in the 1930s with *Drene*, the first shampoo using synthetic surfactants instead of soap. Used initially for laundry and for cleaning carpets and cars, they later evolved as hair shampoo.[4]

What shampoos do?

Shampoos are used primarily to clean the scalp of dirt and other environmental pollutants, sebum, sweat, desquamated corneocytes (scales), and other greasy residues including previously applied hair care products such as oils, lotions and sprays.[5] It is easy to formulate a shampoo which will remove all of the sebum and dirt from the hair and scalp, but this will leave the hair, frizzy, dry, unmanageable and unattractive. Shampoo now is also supposed to have a secondary function which serves to condition and beautify hair and to soothe the irritated scalp skin in conditions like seborrheic dermatitis.[6,7] The challenge is to remove just enough sebum to allow the hair to appear clean and leave behind enough conditioning agents to leave the hair soft, shiny and manageable.[8] This balancing act between good cleaning and beautifying the hair is an art achieved by mixing various ingredients in the correct proportion in the shampoo preparation. The modern advances in chemistry and technology have made it possible to replace the soap bases with complex formulation which contain cleansing agents, conditioning agents along with functional additives, preservative, aesthetic additives and sometimes even medically active ingredients.[1]

What shampoos contain?

Basic formulation of ingredients and their functions for all standard shampoos is listed in [Figure 1](#). [9] It is important to realize that the only ingredients that are important for the cleansing and the manageability of the hairs are the synthetic detergents and the conditioners while the rest aid in the stability, presentability and marketability of the product. A brief discussion of the ingredients is as follows.

Detergents[7,9,10,11,12,13] Shampoos usually contain synthetic detergents (syndets) or surfactants as primary cleansers. A detergent or surfactant is amphiphilic, meaning the detergent molecules contains both lipophilic (oil-attracting) and hydrophilic (water-attracting) sites. The lipophilic sites help to bind sebum and oily dirt while hydrophilic end binds to water; allowing removal of the sebum while washing with water. The most commonly selected shampoo detergents are listed in [Table 1](#).

There are five categories of shampoo detergents: Anionics, cationics, non-ionics, amphoteric and natural. Each of this group possesses different hair cleansing and conditioning qualities. For a shampoo that is intended for oily hair, detergents with strong sebum removal qualities are selected, but if it is intended for permanently waved or dyed hair, mild detergents are selected to reduce sebum removal. Modern shampoos con-

tain a mixture of surfactants (usually between two and four) for providing optimum cleaning levels according to hair type and requirement—normal, oily, dyed, permed, colored or damaged hair. The detergent listed first denotes the primary cleanser which is in highest concentration and the detergent listed second is the secondary cleanser designed to offset the short comings of the primary detergent.

Anionic detergents[[13](#)]

Among the most popular surfactants, they are named for their negatively charged hydrophilic polar group. Derived from fatty alcohols, they are very good at removing sebum from the scalp and hair. However, the excessively cleaned hair is harsh, rough, dull with frizz and prone to tangling. Among them, different classes of detergents are available with certain selective properties.

- **Lauryl sulfates:** Popular primary cleansers, they work well in both hard and soft water, produce rich foam, and are easily rinsed. They are excellent cleansers, commonly used in shampoos for oily hair. As the hair becomes harsh and rough, careful selection of a secondary detergent and possible use of a conditioning agent is always required as part of the shampoo formulation. Examples of this class include: Sodium lauryl sulfate, triethanolamine lauryl sulfate, and ammonium lauryl sulfate
- **Laureth sulfates:** These are another class of excellent detergents with good cleansing ability and foaming property which are useful for normal-to-dry hair. Examples of this chemical class are: Sodium laureth sulfate, triethanolamine laureth sulfate, and ammonium laureth sulfate
- **Sarcosines:** They are generally secondary detergents, as they do not remove sebum well from the hair to justify as primary cleansers. They are listed as the second or third on ingredient list of detergents. Excellent conditioners are used in conditioning shampoos and dry hair shampoos. Examples are: Lauryl sarcosine and sodium lauryl sarcosinate
- **Sulfosuccinates:** These are strong detergents commonly used as a secondary surfactant in oily hair shampoos. Examples are disodium oleaminesulfosuccinate and sodium dioctylsulfosuccinate.

Cationic detergents[[13,14](#)]

In contrast to anionic detergents they have a positively charged polar group. They are poor cleansers and do not lather well and are not compatible with anionic detergents, limiting their utility. However, they are excellent at imparting softness and manageability to chemically damaged hair and so are primarily used as daily shampoo for damaged hair such as in case of permanently dyed or chemically bleached hair. Examples are: Long-chain amino esters, ammonioesters, cetyltrimethylammonium chloride.

Nonionic detergents[[13,15](#)]

They have no polar group and are among the mildest of all cleansers and aid to improve the antistatic qualities of a shampoo. They can be combined with ionic detergent as a secondary cleanser. Examples are: Polyoxyethylene fatty alcohols, polyoxyethylene sorbitol esters and alkanolamides.

Amphoteric detergents[[13,16,17](#)]

Having both positively and negatively charged polar group, they behave differently at lower pH (as cationic detergent) and at higher pH (as anionic detergent). Subgroups include the betaines, sultaines, and imidazolinium derivatives. They are used in baby shampoo and for those with fine and damaged hair because they don't cause stinging in the eyes in children, foam well and leave hair in manageable state. Examples are: Cocamidopropyl betaine and sodium lauraminopropionate.

Natural detergents[[11,13,18](#)]

The fruit pulp of Sapindus, also known as soapberries or soapnuts contains saponins which are a natural surfactant and creates a lather which leaves the hair soft, shiny and manageable. This was used for hair cleansing in India in ancient times. After the advent of synthetic detergents, use of natural detergents became a memory. Recently botanically based hair care products have made resurgence. Natural surfactants come from plants such as sarsaparilla, soapwort, soap bark, and ivy agave. Although they have excellent lathering capabilities, cleansing of hair is poor and their addition is only for marketing purposes.

Conditioners (In shampoo formulations)[[10,13,19,20,21,22,23](#)] Hair-conditioning ingredient functions to impart manageability, gloss, and anti-static properties to the hair. This may be included in the shampoo which then serves dual function of cleaning and conditioning. Procter and Gamble introduced "2 in 1" shampoos/conditioners in 1987 using silicone (dimethicone) droplets suspended in a surfactant mixture. These are useful for those wishing to shampoo daily and for dry, damaged, or chemically treated hair. Commonly used conditioning substances include hydrolyzed silk and animal protein, glycerin, dimethicone, simethicone, polyvinylpyrrolidone, propylene glycol, and stearyl-konium chloride. Protein-derived substances in conditioners can temporarily mend split ends, known as trichoptilosis. Protein attracted to the keratin holds the cortex fragments together until the next shampooing occurs.

Foaming agents[[13,24](#)] They introduce gas bubbles into the water but have nothing to do with cleansing, a common myth among general population that a product which foams better cleans better. Inclusion of foam boosters like cocodiethanolamide as ingredients in shampoo helps to satisfy the customer psyche which equates good foaming with good cleansing though it does help spread the detergent over the hair and scalp. This helps in the commercial success of a shampoo formulation. Sebum inhibits the bubble formulation; therefore, there is more foam during second shampooing.

Thickeners and opacifiers[[13,25,26](#)] These are added to change the physical and optical properties of the shampoo. This improves the cosmetic acceptance. Many shampoos are pearlescent. This effect is achieved by addition of tiny flakes of suitable materials, for example, glycol distearate. Thickeners like salt (sodium chloride) and PEG-150 distearate are used to increase the product viscosity. Again these have no effect on hair cleansing.

Sequestering agents[[13,27](#)] Sequestering agent like polyphosphates and ethylenediaminetetra-acetic acid are used to chelate magnesium and calcium ions. Presence of these ions form insoluble soaps called "scum" over the scalp and hair, may cause itching and exacerbate the symptoms of seborrheic dermatitis while making the hair dull

pH adjusters[[8,13,28,29](#)] As the hair fiber has a pH of 3.67, a pH closer to 3.67 has less possibility to increase the negative electric charge that normally involves the capillary fiber. To address the treatment of the scalp; shampoos must not have a pH higher than 5.5, which is also scalp pH. Hair shaft swelling which occurs due to alkalization of hair shaft after use of most detergents can be prevented by “pH balancing” the shampoo by the addition of an acidic substance, such as glycolic acid or citric acid to adjust the pH down to approximately 5.5. Use of “neutral pH” shampoo helps for chemically treated hair, from either permanent dyeing or permanent waving.

Preservatives[[1,10,13,30](#)] Preservatives resist germs and prevent decomposition of the shampoos. They also prevent various other health risks that accompany contamination by germs and bacteria. Typical preservatives in shampoos are sodium benzoate, parabens, 1,3-dimethylol-5,5-dimethyl (DMDM) hydantoin, tetrasodium EDTA, methylisothiazolinone, or MIT and Quaternium-15.

Specialty additives[[1,10,13,31,32](#)] Recently, an attractive list of ingredients is being added to shampoos ranging from chemical sun screens to vitamins like panthenol, pro-vitamins, botanicals like tea tree oil and even beer. The contact time of shampoos with scalp and hair is too brief to expect significant clinical benefits despite claims to the contrary. These additives serve mainly to allow the distinction of one shampoo from another in terms of marketing claims.

Who should use which shampoo?

A common question of a dermatology patient especially if he or she comes with a hair problem is to ask the type of shampoo he or she should use for their type of hair. Dermatologists are expected to be familiar with the basic types of shampoos available in the market. These are listed in [Figure 2](#) and have the following properties and uses:[[13](#)]

Normal hair shampoo is for people who have hair which are chemically untouched and scalp which produces moderate sebum. Favorite with men. Normal hair shampoos use lauryl sulfate as the primary detergent providing good cleansing and minimal conditioning.

Dry hair shampoo is for people who have undergone chemical treatment or harsh styling procedures. These shampoos provide mild cleansing and good conditioning.

Oily hair shampoo is for people who produce abundant sebum. They contain lauryl sulfates or sulfosuccinates as detergents and no conditioners.

Everyday shampoo is for people who want to daily wash their hair along with bath lest they feel dirty. They generally contain mild detergents and typically do not incorporate the conditioners. But an instant stand-alone conditioner is recommended which can be applied immediately after shampooing in the shower and completely rinsed from the hair prior to drying.

Deep cleaning shampoo is for people who frequently use styling products, such as hair spray, gel, and mousse. These polymers build up on the hair shaft after continuous use and make the hair look rough, dull and feel harsh. To remove these polymers, a strong detergent like lauryl sulfates is used as their primary detergent. These shampoos are typically used once weekly.

Baby shampoo is for babies where mild detergent is used which is non-irritating to the eyes and achieves mild cleansing, as babies produce limited sebum. They contain the amphoteric group detergents, such as the betaines which actually numbs the eye tissues to prevent stinging and irritation.[[33,34](#)] So it can still potentially damage the eye if accidentally introduced and care should be taken while bathing the child.

Medicated shampoo is used for people with scalp problems like seborrheic dermatitis, psoriasis, bacterial or fungal infections. In addition to regular cleansers they contain active agents such as Tar derivatives, corticosteroids, salicylic acid, sulfur, selenium sulfide, polyvinylpyrrolidone-iodine complex, chlorinated phenols or zinc pyrithione.[[35,36,37](#)] Details regarding medicated shampoos are beyond the purview of this article. Two in one (popularly known as “2-in-1”) shampoos, which contain silicone in the form of dimethicone as conditioner, and mild detergents, such as the laureth sulfates or cationic detergents, which produce reasonably good foam.[[10](#)] Thus, after shampoo the sebum is replaced with silicone to make the hair shiny, soft, and free of static electricity.

Professional shampoos are not for ordinary people but for use of professional hair stylist and cosmetologist. They are either used before a cutting or styling procedure or before and after a chemical process like bleaching and dyeing or coloring process. Briefly these shampoos have ingredients in extremely concentrated forms or special anionic or cationic detergents that neutralize the harsh effects of chemicals on hair shaft or remove the residues of chemicals applied to achieve a particular hair style or color. They are not to be used for day to day hair care.

How frequently can shampoo be used for washing hair?

The frequency of hair washing is usually an individual preference and is influenced by length of hair, culture, sex, social pressures, and economics. Frequent and regular cleaning with a well-formulated shampoo will not damage the hair. So there is no upper limit of frequency provided regular conditioner is used.[[10](#)] There is a wealth of evidence to show that modern, well-formulated, mild shampoos do not interfere with mitosis in the growing matrix of hair and may indeed help fragile hair by decreasing grooming force.[[21,38](#)]

Hair Conditioners

How are conditioners useful?

Conditioning agents can be defined as additives which enhance feel, appearance, fullness, lubricity, reflectance, and general manageability of hair.[[20,39](#)] The need for hair conditioner arose following technological developments in shampoo formulation which lead to efficient removal of sebum along with dirt and other undesirable residues from the hair and scalp. Sebum being the ideal hair conditioner had to be replenished. Therefore, the need was felt for a synthetic sebum like substance or a conditioner which was able to minimize static electricity, increase hair shine, volume and improve hair manageability and also to maintain hair styling.[[40](#)] They are also used to recondition the hair following chemical treatments, such as waving, straightening, and coloring, and following physical trauma induced by hair drying, brushing, and styling.[[41](#)]

How do conditioners act?

Conditioner molecules contain cationic surfactant which gives a positive electric charge to the conditioner. The negative charge of the hair is attracted to the positively charged conditioner molecules, which results in conditioner getting deposited on the hair, especially on areas where there is degree of weathering.[[1,42,43](#)] This is true for damaged hair as they are even more negatively charged. Thus, conditioners reduce the static electricity. They also flatten the cuticle scales over the hair shaft, reducing the friction between hair fibers, increasing the reflectance of light which improves shine and color.[[44](#)] The smooth feel resulting from conditioner use gives easier combing and detangling in both wet and dry conditions.[[1](#)] Conditioners temporarily seal split ends and mend trichoptilosis.[[45](#)]

What do conditioners contain?

There are several different active agents that can be combined to achieve a hair conditioner designed for a given hair type. Conditioners are essentially cationic systems that, for best effect, are presented as dispersions rather than solutions.[[10](#)] Conditioners consist of the following ingredients:[[46,47,48,49](#)]

- Cationic surfactants: Cetyltrimethylammonium chloride, behentrimonium or propyltrimonium, stearamidopropyl dimethylamine. They are considered the backbone of a conditioner
- Polymers: Mono and polypeptides like hydrolyzed proteins (amino acids), polypeptides derived from collagen and polyvinylpyrrolidone (PVP)
- Bodying agents and thickeners: Fatty alcohols (e.g. cetyl alcohol and stearyl alcohol), waxes (e.g. carnauba wax and paraffin wax), or gums (e.g. guar gum) and salt (sodium chloride)
- Emollients/oily compounds: These include natural or synthetic oils, but also esters and waxes. Natural oils used in conditioners are, for example, jojoba oil, olive oil, or grape seed oil. The most frequently used synthetic oils are silicone (e.g. dimethicone, dimethiconol, amodimethicone and cyclomethicone) which are even superior to natural oils in terms of film formation, shine and luster. Asian countries have large hair diameters, therefore a higher concentration of silicone is used as compared to that for Caucasian hair (3-5% vs 0.5%)[[1](#)]
- Auxiliary emulsifiers: Ethoxylated fatty alcohols (e.g. polysorbate-80 or cetareth-20) which are non-ionic agents seem to be particularly effective at providing emulsion stability if it cannot be achieved by cationic agents alone in a conditioner.

How are conditioners used?

Hair conditioners are used in several ways depending upon their need. They are summarized below:[[44,48,50](#)]

Instant conditioners

Instant conditioners are the most common. They are applied immediately after shampooing and are left for a short period of time (around 5 min) before rinsing. They are ideal for daily use with minimally damaged hair. They are the most popular type of conditioner for both salon and home use.

Deep conditioners

Deep conditioners, also known as intensive hair conditioners, are similar to instant conditioners, except they are more concentrated and are left on the hair for 20 to 30 minutes. They are usually used for extremely dry hair and also before chemical treatment such as coloring and waving. If they are used prior to chemical hair processing, they are known as “Fillers.”

Blow drying conditioners

Blow drying lotions are similar to instant conditioners, but they do not contain oil and therefore can be left on the hair and are useful for people with fine hair and excessive scalp sebum.

Hair glaze or hair thickeners conditioners

They coat hair shaft, increasing their diameter minutely and giving the illusion of thick hair. They usually contain proteins as conditioners.

Can shampoos and conditioners cause adverse effects?

Adverse reactions to shampoos and conditioners are rare. It is known that a pH higher than 5.5 may cause irritation of the scalp.[28] In the hair itself, damage to hair shaft can occur if the wrong kind of shampoo is consistently applied with respect to the type of hair a person has especially if no conditioners are applied for protection and restoration. Reports of allergic or irritant contact dermatitis, accidental contact with the mucous membranes of nose and eye, delayed wound healing, buildup of detergents like sodium lauryl sulfate in heart, liver, lungs, brain and the rare possibility of carcinogenicity are reasons for being cautious when a person complains of skin eruptions around application sites and a feeling of unease with these hair care products.[31,51,52,53,54,55] If patch testing to a shampoo is required, the shampoos should be diluted to form a 1–2% aqueous solution for closed patch testing and a 5% aqueous solution for open patch testing.[13]

Conclusions

Shampoo and conditioners are hair care products which have become a part of day to day grooming of individuals and queries related to them are frequently put up to a dermatologist by patients with or without hair pathologies. This article attempts to put basic and practical aspects in the grasp of the reader so that the next patient can be offered reasonable advice regarding their specific problems and apprehensions regarding use of these products. This would also help in obtaining better compliance of these patients while treating their core dermatological disorders.

What is new?

- Hair shampoos also have secondary functions of ameliorating scalp irritation due to various causes of scalp dermatoses and aiding to leave the hair soft, shiny and manageable
- Depending upon need, various type of shampoos (dry hair, oily hair, normal hair, and baby shampoo, etc.) are available
- Protein-rich conditioners are known to seal temporarily split ends and give illusion of thick hairs.

Footnotes

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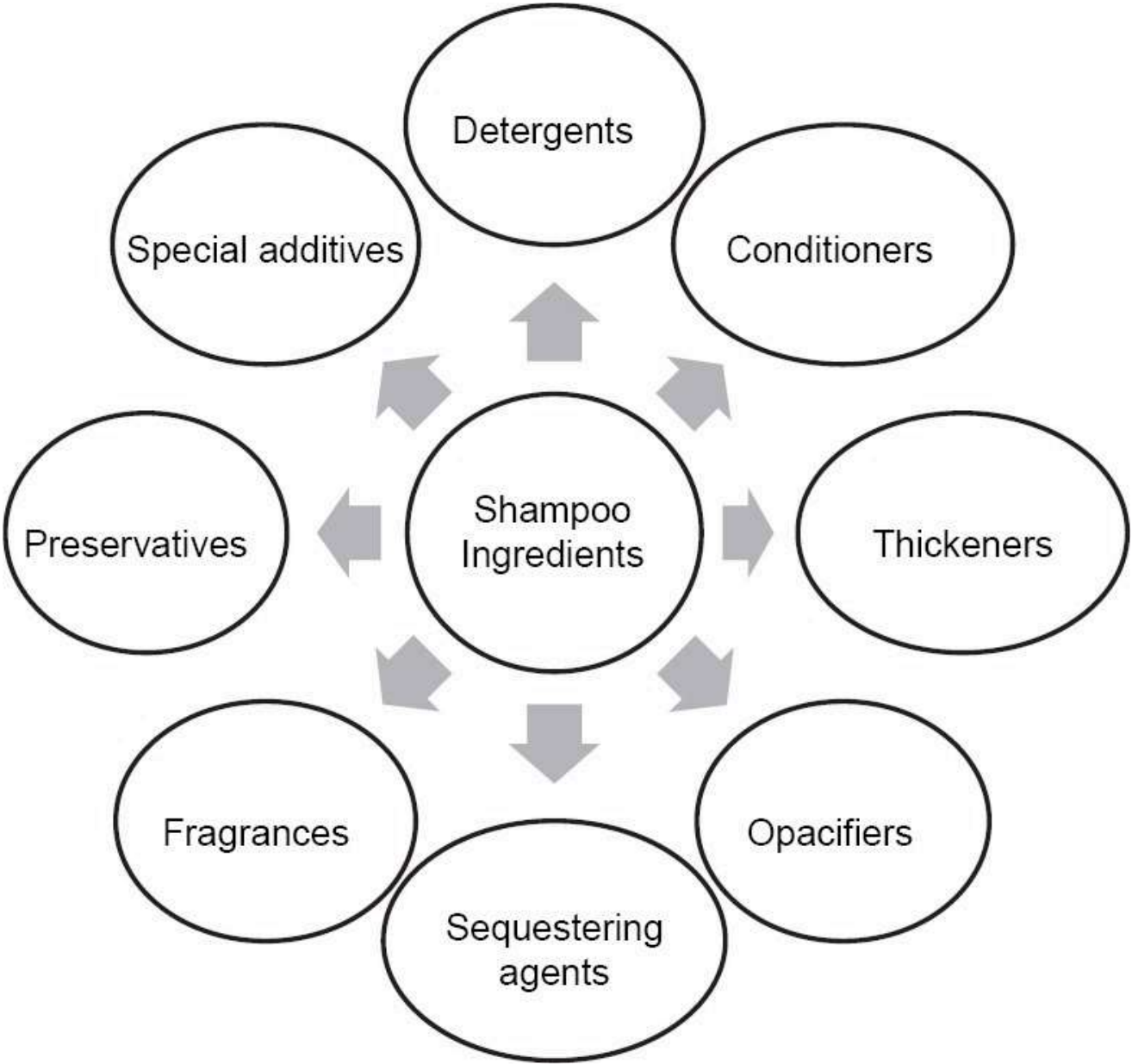
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Figure 1



Basic ingredients present in a shampoo

Table 1

Shampoo detergents

Surfactant type	Chemical class	Characteristics
Anionics	Lauryl sulfates, laureth sulfates, Sarcosines, Sulfosuccinates	Deep cleansing may leave hair harsh
Cationic	Long chain amino esters, Ammonioesters	Poor cleansing, poor lather, impart softness and manageability
Nonionics	Polyoxyethylene fatty alcohols, polyoxyethylene sorbitol esters alkanolamides	Mildest cleansing, impart manageability
Amphoteric	Betaines, sultaines, Imidazolinium derivatives	Non irritating to eyes, mild cleansing, impart manageability
Natural surfactant	Sarsaparilla, soapwort, soap bark, ivy, agave	Poor cleansing, excellent lather

Courtesy *Adapted from Draelos ZD^[8]

Figure 2



Basic shampoo types