Skin and Hair Cleansers

Cleansing of the skin is a complex interaction between the stratum corneum barrier, environmental dirt, body secretions, and a surfactant. Washing of the skin is the single most common cause of dermatologic disease, yet it is very necessary in terms of personal hygiene and health.

Soap

Most cleansing is accomplished with a product known as soap, which is obtained through the chemical reaction between a fat and an alkali, resulting in a fatty acid salt with detergent properties. Modern refinements have attempted to adjust its alkaline pH, possibly resulting in less skin irritation, and to incorporate substances that prevent precipitation of calcium fatty acid salts in hard water, known as soap scum.

Nevertheless, modern soap is basically a blend of tallow and nut oil, or the fatty acids derived from these products, in a ratio of 4:1. Increasing this ratio results in "superfatted" soaps designed to leave an oily film behind on the skin. Bar and liquid cleansers can be divided into 3 basic types, as follows:

1. True soaps composed of long chain fatty acid alkali salts with a pH of 9-10
2. Combars composed of alkaline soaps to which surface active agents have been added, also with a pH of 9-10
3. Syndet (synthetic detergent) bars composed of synthetic detergents and fillers that contain less than 10% soap and have an adjusted pH of 5.5-7

The purpose in developing new synthetic detergents over traditional soaps was to provide a product less irritating to the skin. Commonly used detergents in bar-type cleansers are sodium cocoate, sodium tallowate, sodium palm kernelate, sodium stearate, sodium palmitate, triethanolamine stearate, sodium cocoyl isethionate, sodium isethionate, sodium dodecyl benzene sulfonate, and sodium cocoglyceryl ether sulfonate.

Detergents in liquid formulations are sodium laureth sulfate, cocoamido propyl betaine, lauramide DEA, sodium cocoyl isethionate, and disodium laureth sulfosuccinate.

The normal pH of the skin is acidic, between 4.5 and 6.5. Applying alkali soap theoretically raises the pH of the skin, making it feel dry and uncomfortable. However, healthy skin rapidly regains surfactant; induced irritation remains a controversial area under investigation.

Special additives to the previously discussed formulations allow the tremendous variety of soaps marketed today. Lanolin and paraffin may be added to a moisturizing syndet soap to create a superfatted soap, while sucrose and glycerin can be added to create a transparent bar. Adding olive oil instead of another form of fat distinguishes a Castile soap.

Medicated soaps may contain benzoyl peroxide, sulfur, or resorcinol antibacterials, such as triclocarban or triclosan. Triclocarban is excellent at eradicating gram-positive organisms, but triclosan eliminates both gram-positive and gram-negative bacteria. These soaps have a pH between 9 and 10 and may cause skin irritation. Moisturizing syndet bar soaps contain sodium lauryl

isethionate with a pH adjusted to 5-7 by lactic or citric acid. These products are less irritating to the skin and sometimes are labeled beauty bars. Most bar soaps marketed by cosmetic companies are of this type.

Additives to soap also are responsible for a characteristic appearance, feel, and smell. Titanium dioxide is added in concentrations as high as 0.3% to opacify the bar and to increase its optical whiteness. Pigments, such as aluminum lakes, can color the bar without producing colored foam, a characteristic considered undesirable. Foam builders, such as sodium carboxymethylcellulose and other cellulose derivatives, can make the lather feel creamy. Perfume in concentrations of 2% or more also can be added to ensure that the soap bar smells until completely used.

Lipid-free cleansers

Lipid-free cleansers are liquid products that clean without fats. They are applied to dry or moistened skin, rubbed to produce lather, and rinsed or wiped away. These products may contain water, glycerin, cetyl alcohol, stearyl alcohol, sodium laurel sulfate, and, occasionally, propylene glycol. They leave behind a thin moisturizing film and can be used effectively to remove facial cosmetics and dirt in persons with sensitive or dermatitic skin. Lipid-free cleansers have been shown to cause less cutaneous irritation in photoaged skin. However, propylene glycol can cause stinging, and sodium laurel sulfate is a detergent.

Cleansing creams

Cleansing creams are applied to the face both to clean and moisturize. They are composed of water, mineral oil, petrolatum, and waxes. The classic cream for facial cleansing is known as cold cream. Cold creams combine the effect of a lipid solvent, such as beeswax and mineral oil, with detergent action from borax, also known as decahydrate of sodium tetraborate. These products are popular to remove cosmetics and to provide cleansing for patients with dry skin.

Exfoliant cleansers

Exfoliant cleansers use an abrasive sponge or abrasive scrubbing granules in a cleansing base to remove skin scale. The particulate exfoliant cleansers incorporate polyethylene beads, aluminum oxide, ground fruit pits, or sodium tetraborate decahydrate granules to remove desquamating stratum corneum from the face. Aluminum oxide and ground fruit pits provide the most abrasive scrub, followed by polyethylene beads, which are softer. Sodium tetraborate decahydrate granules become softer and dissolve during use, providing the least abrasive scrub.

Body washes

Body washes are a special subset of liquid synthetic detergents that combine mild skin cleansing with moisturizing and emollient qualities. They are applied with a puff that does not support bacterial growth to break the emulsion through the incorporation of generous amounts of air and water. High amounts of petrolatum can be incorporated in body wash emulsions to improve skin dryness and hydration.

Hair cleansing is a more complex interaction than skin cleansing, since the surface to cleanse is much greater, consisting of the scalp and all surfaces of each hair shaft. Products designed to cleanse the hair are known as shampoos.

Formulation

Shampoos basically contain detergents, foaming agents, conditioners, thickeners, opacifiers, softeners, sequestering agents, fragrances, preservatives, and specialty additives. Detergents are the primary sebum and dirt removal shampoo components; however, excessive removal of sebum leaves the hair dull, susceptible to static electricity, and difficult to comb. Furthermore, consumers equate cleansing ability with abundant, long-lasting foam. Excessive bubbles are not a technical requirement for good hair cleansing and bacteria

removal, but shampoo manufacturers add increased amounts of detergents, in addition to foam boosters, to obtain the foam that is desired by consumers. This increased concentration of detergent creates the need for conditioners and other additives in shampoos to improve their cosmetic acceptability.

Detergents

Shampoos function by employing detergents (also known as surfactants) that are both lipophilic (oil-loving) and hydrophilic (water-loving). The lipophilic component adheres to sebum and the hydrophilic component allows water to rinse away the sebum.

Some of the most common synthetic detergents combined into various shampoo formulations for various needs are as follows:

- Lauryl sulfates (sodium lauryl sulfate, triethanolamine lauryl sulfate, ammonium lauryl sulfate) are found in most shampoos as the main surfactant since they work well in both hard and soft water, produce rich foam, and are easy to remove. This group produces good cleansing but is hard on the hair.
- Laureth sulfates (sodium laureth sulfate, triethanolamine laureth sulfate, ammonium laureth sulfate) produce rich foam, provide good cleansing, and leave hair in good condition. They also are a common main surfactant.
- Sarcosines (lauryl sarcosine, sodium lauryl sarcosinate) are poor cleansers but are excellent conditioners. This group commonly is used as a secondary surfactant.
- Sulfosuccinates (disodium oleamine sulfosuccinate, sodium dioctyl sulfosuccinate) are strong degreasers and commonly are used as a secondary surfactant in oily hair shampoos.

The aforementioned detergents are classified as anionic surfactants because of their negatively charged hydrophilic polar group. Another group of detergents, the

cationic detergents, is named for their positively charged polar group. They are relatively poor detergents and do not lather well, but their unpopularity is largely due to their incompatibility with other anionic surfactants. Some shampoos designed for dyed or bleached hair use cationic detergents because they are excellent at imparting softness and manageability.

The nonionic detergents, the second most popular group of detergents behind the anionic surfactants, possess no polar group. These are the mildest of all surfactants and are used in combination with anionic surfactants as a secondary cleanser. Examples include polyoxyethylene fatty alcohols, polyoxyethylene sorbitol esters, and alkanolamides.

The amphoteric detergents contain both an anionic and a cationic group so that they behave as cationics at lower pH values and anionics at higher pH values. The detergents that fall within this group are the betaines, sultaines, and imidazolinium derivatives. Such ingredients as cocamidopropyl betaine and sodium lauraminopropionate are found in baby shampoos, since they are nonirritating to the eyes. These surfactants foam moderately well and leave the hair manageable, making them a good choice for chemically treated and fine hair.

Foaming agents

Foaming agents in shampoos introduce gas bubbles into the water. Many consumers believe that shampoos that generate copious foam are better cleansers than poorly foaming shampoos. This is not true. As the shampoo removes sebum from the hair, the amount of foam will decrease because sebum inhibits bubble formation. This accounts for the increased foam seen on the second shampooing, when most of the sebum has been removed.

Thickeners and opacifiers

Thickeners and opacifiers have no part in hair cleansing. They simply make the product more appealing to the consumer. Many people incorrectly believe that a thick shampoo is more concentrated than a thin shampoo; others want a shampoo that appears opaque or pearlescent.

Conditioners

Conditioners impart manageability, gloss, and antistatic properties to the hair. They are found in most shampoos for dry, damaged, or treated hair. They usually are fatty alcohols, fatty esters, vegetable oils, mineral oils, or humectants. Many conditioners are used in dry hair shampoos, including hydrolyzed animal protein, glycerin, dimethicone, simethicone, polyvinylpyrrolidone, propylene glycol, and stearalkonium chloride.

Sequestering agents

Sequestering agents make shampoos function better than bar soaps in cleansing the hair. They chelate magnesium and calcium ions so that other salts or insoluble soaps, known as scum, are not formed. Without sequestering agents, shampoos would leave a film on the hair.

pH adjusters

Some shampoos contain ingredients designed to alter pH, allowing the marketing claim of "pH balanced." Most shampoos are alkaline, which can swell the hair shaft and render it more susceptible to damage. This is not a problem for patients with healthy, nonporous hair containing an intact cuticle. Patients with damaged or chemically treated hair with a fragmented cuticle may wish to avoid hair swelling by selecting a shampoo that has an acid added to balance the pH.

Specialty additives

The key differences between similar purpose shampoos manufactured by various personal care product companies are the fragrance and special care additives.

Such additives as wheat germ oil (containing vitamin E) and panthenol (a form of vitamin B) are added mainly because they are believed to leave hair more silky and manageable. Other producers add fatty substances, such as plant extracts or mink oil. Proteins, such as ribonucleic acid, collagen, and placenta, may be added to act as conditioners. Some shampoos now include a chemical sunscreen.

Types of shampoo

Shampoos have been formulated in liquids, gels, creams, aerosols, and powders. Only the liquids are discussed in this article because they are the most popular. A number of different types of shampoos also are available, including basic shampoos (normal, dry, oily, and chemically treated hair shampoos), baby shampoos, conditioning shampoos, medicated shampoos, and professional shampoos.

Basic shampoos

Basic shampoos may be selected from several formulations depending on the amount of scalp sebum production, hair shaft diameter, and hair shaft condition. The label usually defines the intended consumer by stating normal hair, oily hair, dry hair, or damaged, colored-treated hair. Some companies alter the concentrations of detergents and conditioners to make different formulations, but the ingredient lists may be identical for all formulations. Other product lines have different formulations for each type.

Normal hair shampoos use lauryl sulfate detergents, giving them good cleansing and minimal conditioning characteristics. These products work well for adults with moderate sebum production and coarse hair; however, they do not work well for persons with fine, unmanageable hair.

Oily hair shampoos have excellent cleansing and minimal conditioning properties. They may use lauryl sulfate or sulfosuccinate detergents and are

intended for adolescents with oily hair or persons who have extremely dirty hair. They can be drying to the hair shaft if used daily. Following an oily hair shampoo with use of a heavy conditioner is self-defeating.

Dry hair shampoos provide mild cleansing and good conditioning. Some companies recommend the same product for dry hair and damaged hair. These products are excellent for mature persons and those who wish to shampoo daily. They reduce static electricity and increase manageability in fine hair; however, some products provide too much conditioning, which may result in limp hair. Dry hair shampoos also may cleanse so poorly that conditioner can build up on the hair shaft. This condition has been labeled as the "greasies" in popular advertising and may account for the observation that hair sometimes has more body after using a different shampoo.

Damaged hair shampoos are intended for hair that has been chemically treated with permanent hair colors, hair bleaching agents, permanent waving solutions, or hair straighteners. Hair also can be damaged physically by over cleansing, excessive use of heated styling devices, and vigorous brushing or combing. Longer hair is more likely to be damaged than shorter hair since it undergoes a natural process known as weathering, whereby the cuticular scales are decreased in number from the proximal to distal hair shaft. As mentioned previously, damaged hair shampoos may be identical to dry hair shampoos or may contain mild detergents and increased conditioners. Hydrolyzed animal protein is the superior conditioner for damaged hair since it can minimally penetrate the shaft and temporarily plugging surface defects, resulting in hair with a smoother feel and more shine. It is important that the protein is hydrolyzed; larger protein molecules cannot penetrate the hair shaft.

Baby shampoos

Baby shampoos are nonirritating to the eyes and designed as mild cleansing agents since babies produce limited sebum. These shampoos use detergents

from the amphoteric group. Baby shampoos also are appropriate for mature hair and for individuals who wish to shampoo daily.

Conditioning shampoos

Conditioning shampoos may be labeled as such or may be labeled as shampoos for dry or damaged hair. Detergents used in conditioning shampoos generally are amphoterics and anionics of the sulfosuccinate type. These products sometimes are known as one-step shampoos, since a conditioner need not be applied following shampooing.

Medicated shampoos

Medicated shampoos, also known as dandruff shampoos, contain additives, such as tar derivatives, salicylic acid, sulfur, selenium disulfide, polyvinylpyrrolidone-iodine complex, chlorinated phenols, or zinc pyrithione. Medicated shampoos have several functions that include the following: to remove sebum efficiently, to remove scalp scale, to decrease scalp scale production, and to act as an antibacterial/antifungal. The shampoo base removes sebum, while mechanical scrubbing removes scalp scale. Tar derivatives commonly are used as anti-inflammatory agents. Sulfur and zinc pyrithione are used for their antibacterial/antifungal qualities. Menthol is added to some shampoos to produce a tingling sensation that some patients find esthetically pleasing.

Adverse reactions

Shampoos do not represent a common cause of cutaneous irritant or allergic contact dermatitis because of their relatively brief contact with the skin prior to rinsing. However, eye irritation can be a problem, which some shampoos overcome with the addition of imidazoline-type amphoteric surfactants, succinic ester sulfonates, silicone glycols, and fatty acid-peptide condensates. Ingredients in shampoos that are possible sensitizers include formalin, parabens, hexachlorophene, fragrances, triclosan, and miranols.

Shampoos should be diluted to form a 1-2% aqueous solution for closed patch testing and a 5% aqueous solution for open patch testing. However, false-positive reactions due to irritation still may occur. A better assessment may be obtained by patch testing individual ingredients separately.