Specifying Pet Shampoo - The Basics

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Dozens of new products have been formulated for a variety of positive outcomes, but which to select can be difficult. Coat type, condition, irritation, odor, oiliness, thickness of hair all influence the decision.

Pet grooming consists of many processes. As bathing is often the first step, careful selection of shampoos, conditioners and other liquids is crucial if the desired results are to be achieved.

Experienced groomers select professional shampoos, as the majority of these products are reliable, high-quality concentrates that reduce both space needs and incoming freight costs.

Shampoo selection is often based on personal experience with professional products. Groomers are also aware of the differences between personal care shampoo and professional pet grooming shampoo. For example, groomers know that the pH of pet and human skin varies. While human skin is acidic, ranging between 5.3-5.5, the pH of a dog’s skin is much higher and more neutral, ranging from 6.7-7.4.

This article examines four primary topics that influence purchasing decisions. First, coat type, structure and condition are discussed. Next, the article discusses those ailments which require that angry, irritated skin be both cleansed and treated. Third, coat enhancers which, post bathing, affect texture, color and manageability, will be covered. Finally, flea and tick issues and their associated skin conditions are examined.

Pets do not specify shampoos, conditioners and other related products. People, specifically groomers, select products for their canine customers in much the same way they select products for themselves. There are so many shampoos available that even the most up-to-date and knowledgeable groomer can be overwhelmed. The professional groomer is the best source of information and feedback when developing new formulations.

Fragrance, viscosity and foam are the three leading attributes, influencing a purchase. First, the shampoo bottle is opened for a fragrance check. If the scent is appealing, the product will most likely be purchased. Once in the shower, the bottle is opened and the shampoo is poured into the hand. If the shampoo is thick and pours slowly, it is perceived as “rich.” If the shampoo lathers quickly and profusely when applied to hair, it is assumed that the shampoo is effective. It is not uncommon for people to shampoo their hair twice, since shampooing only once may not result in the desired amount of foam. While these attributes are important, they do not contribute to the cleansing action desired from a shampoo.

Cleansing should not be confused with foaming. The most general definition of foam is a substance that is formed by trapping many gas bubbles in a liquid or solid. Foam is a distinctive attribute of shampoos. It is produced by introducing gas or air into the water and stabilized by surfactants.

Foaming is important because it provides lubricity, needed for the groomer’s fingers and tools to work their way through the coat, allowing easier mechanical action through the hair.

Aware of the consumer’s perception and purchasing decisions, formulators develop products that bear these attributes. It is not surprising that the groomer’s perception of a “quality” pet shampoo is influenced by its fragrance, feel and foaming action. Experienced groomers, however, consider these three characteristics, but look beyond and focus on the specific needs of the skin and coat. Along with cleansing, shampoos must not cause skin irritation.

Shampoo is primarily designed to remove soil, consisting of sebum oil-like material and trapped debris from the hair. Depending on the level of strength, some shampoos may strip the hair of their natural oils and leave hair dry and brittle. The groomer must then select a product, whether shampoo or conditioner that has refatting and moisturizing agents to “put back” or replenish the coat’s needed oils and moisture.

Shampoo 101 Water and oil - Micelle diagram Owing to its consistency and adhesion, soil cannot be removed, for all practical purposes, from hair by mere mechanical work. The main role of shampoo is to loosen the physiochemical bonds
between soil and hair and to carry them into a water medium. The term “surfactant” always comes up when talking about the physiochemical composition of shampoo. Interestingly, the word surfactant is much like the word “Kleenex.” Surfactant is short for “surface-active agent,” and is an expired (turned to public domain in 1950 by GAF Corporation) trademark.

Surfactants have a dual affinity: they are both oil loving and water loving. This property originates from their molecular structure; they are made of a long so-called fatty hydrocarbon chain having a water soluble head. The principle that illustrates the function of surfactants or surface active agents is shown by the diagram of Micelle. Pronounced “my cell,” the diagram illustrates the basics of cleansing action. Each needle-looking object represents an amphipathic molecule. Amphipathic describes the coexistence of two normally opposed or different entities on a single platform. Examining the figure showing the micelle, one sees an arrangement composed of elements that resemble pins. Each pin or platform has a point and a head. The pinpoint is oil loving or lipophilic; and the head is water loving or hydrophilic. The oil side is attracted to oils and the water side is attracted to water. When there are many of these molecules in a water base, the molecules align themselves so that all the heads are in contact with the water, while the tails are protected from the water. The simplest arrangement of this condition is a sphere where all the heads form the surface of the sphere, the tails being interior to the sphere. This model simplifies the visualization of the micelle, showing that the interior of the sphere will trap oil molecules and let them be rinsed away.

Sebum, generated by the sebaceous glands, along with other oils with debris particulate that adhere to it, are surrounded by the oil-loving center of the micelle. Once trapped inside the micelle, the oils (sebum and imbedded debris) are carried away in the rinse water. As a general and simple concept, this is the cleansing process.

Surfactants are synthesized from a fatty base referred to as triglycerides which are derived either from animal or vegetable fats and oils. The constituents of triglycerides are a derivative of glycerol and an acid. The acids are therefore called “fatty acids.” The fatty acids are used as ingredients in shampoo to provide conditioning to thicken and provide opacity and when neutralized, to provide cleansing and foaming properties. Fatty acids are the material from which surfactants are produced.

Nonionic surfactants, usually considered to be very mild, carry no charge in their molecule. They include a large number of

Anionic surfactants are characterized by a negative charge on the "head" of the molecule (imagine the molecule looking like a pin with a head and a prickly point). Anionic surfactants have been the workhorse of cleansing agents from the time they were first produced. There are many different types of anionic surfactants since they are relatively simple to synthesize. Anionic surfactants are excellent foaming and cleansing agents partly because of the shape of the surfactant molecule.

Cationic surfactants have a positive charge on the head of the molecule. They possess two important qualities: they are substantive (are attracted and will attach themselves) to negatively charged surfaces; and they have anti-microbial properties. Cationic surfactants do not have cleansing properties. Since hair is negatively charged, they attach to hair shaft and provide conditioning. Because cationic surfactants have a positive charge, they are usually not compatible with anionic-based shampoos. Cationic molecules are attracted to anionic molecules. They combine with each other to form a neutral insoluble complex. Because of the anti-microbial properties of cationic surfactants, they are used as preservatives, sanitizing and disinfecting agents. Many cationic surfactants incorporate an ammonium molecule and are known as quaternary compounds.
compounds whose flexibility of design is their distinctive feature. They generally have good solubilizing and dispersing properties and can be tailored to meet cleansing requirements. Several types of nonionic surfactants are significant in shampoo formulations. As a general class, they are not used as principal ingredients. They are most often used as additives to the basic shampoo formula. Nonionic surfactants are often not very hydrophilic and require another surfactant to solubilize them. They are used in shampoo formulations as foam boosters, foam stabilizers and viscosity modifiers. By themselves, nonionic surfactants are generally not very good cleansing and foaming agents and, except in special cases, cannot be used as the primary surfactants. Many shampoo formulations incorporate nonionic surfactants to create milder cleansing products.

Amphoteric surfactants contain both anionic and cationic solubilizing groups. The dominant feature depends on the pH of the medium. At acid (low) pH, the cationic group prevails and at alkaline (high) pH, the anionic group prevails. At neutral pH or slightly below neutral pH, the molecule is dipolar as it bears both positive and negative charges simultaneously. Amphoteric surfactants are used because they are very mild to skin and eyes. They do not foam or clean as well their anionic relatives, but are ideal partners to powerful anionic cleansers to make them milder. The use of milder amphoteric surfactants is often recommended for gentle shampoo formulations, such as baby shampoo.

Shampoo appearance may be: clear liquids; opaque (pearlescent) liquids; gels; creams; foam; aerosol; and pump. There are a multitude of shampoo types, including conditioning, baby, color protecting, color enhancing and deodorizing.

To achieve the desired properties of shampoo, most formulations consist of the following type of ingredients:

- Primary surfactant (cleanser)
- Secondary surfactant (foam booster/stabilizer)
- Thickener
- Opacifier (provides pearlescent appearance)
- Conditioners
- Performance additives
- Sequestering and chelating agents
- Preservatives
- Color
- Fragrance

The function of primary surfactants is to confer cleansing properties to the shampoo. Ingredients used most often as primary surfactants include alkyl sulfates and alkyl ether sulfates. The most well-known primary surfactants, used in more than 80% of shampoo formulations, are:

- Sodium Lauryl Sulfate (SLS)
- Ammonium Lauryl Sulfate (ALS)
- Sodium Lauryl Ether Sulfate, also known as Sodium Laureth Sulfate (SLES)
- Ammonium Lauryl Ether Sulfate, also known as Ammonium Laureth Sulfate (ALES)

While these four surfactants are the most popular, other surfactants, such as alpha olefin sulphonates, sulphosuccinates, taurates and sarcosinates, can be found in shampoo formulations.

The function of the secondary surfactant in a shampoo system is to stabilize the foam, enhance viscosity and also mitigate the irritancy of the primary cleansing surfactant. Secondary surfactants are often nonionic and amphoteric. The mechanism used to thicken shampoo formulation depends largely on the type of surfactants used. In shampoo systems where the primary surfactants are ALS, SLS or ALES and SLES, viscosity enhancement is often achieved by using salts, such as sodium chloride or ammonium chloride.

Opacity or pearlescence in a shampoo can enhance consumer appeal and can be provided by various materials, most of which are waxy and crystalline in nature. The pearlescence obtained will depend on the size, shape distribution and reflectance of the opacifier crystals formed.

The use of conditioning agents in shampoo formulation is often a formulator challenge. Conditioning agents were not present in shampoo formulations until a decade or so ago. Most conditioning agents are cationic and tend to combine with the anionic surfactants and form an insoluble compound. Recognizing the need for conditioning shampoos, the industry has developed specialized cationic
polymers and amino-functional silicones that will coexist with anionic surfactants.

Performance additives are normally incorporated into shampoos that are designed to accomplish special functions. Examples of such products are medicated, antidandruff, and ant-itch shampoos. Active agents include coal tar, sulfur, salicylic acid, selenium sulfide and zinc pyrithione. Incorporating and suspending these agents requires that suspending properties be provided to the shampoo formulation. For pet shampoo applications, medicated shampoos incorporate other agents that are designed to treat skin diseases.

Where does the oil come from?
Oil comes from sebaceous glands located beneath the surface of the skin.

Sebaceous glands are located wherever there is hair on the dog. Just like humans, skin is the dog’s largest organ.

The sebaceous glands appear as foamy lobes of epithelial cells that are attached to the mid-portion of the hair follicle through a short duct. Generally, the sebum is secreted on the hair’s shaft inside the follicles and is brought up to the surface of the skin along the hair shaft. Although these glands are attached to the hair follicles of every mammal, their function is controversial. Sebum lubricates and protects the hair and skin and prevents drying and irritation of membranes. Sebum coats and possibly enhances the barrier function of the outer layers of the skin. While coating the hair shafts, sebaceous secretions produce the sheen, which makes the coat of a healthy dog or cat attractive. Sebum has the ability to waterproof the skin as evidenced in ducks which utilize secretions of a modified sebaceous gland to coat their feathers and keep them dry in water. Some of the sebum’s fats keep bacteria from growing, and it has been speculated that sebum plays a role in preventing bacterial infections. Sebum, however, may collect excessively as a result of infrequent bathing, a diet rich in fats, or accelerated glandular activity. Excessive secretions of sebum may be related to skin disorders.

If sebum offers so many benefits, why remove it? Along with its many benefits, sebum is inherently tacky, creating a magnet for loose skin, airborne particulate, soil, urine, food and other loose debris. In addition to appearance issues, bacteria that breed in the sebum are the root cause of “doggie” odor. Cleansing action of the shampoo reduces, emulsifies and generally washes away these undesirable items. Aware of the importance of sebum for healthy skin and hair, it is clear that replenishing the skin with organic and natural substitute oils is needed. Some of these ingredients are known as refatting agents since they restore some of the natural oils on the hair shaft.

“Put back” is what we expect and get from conditioners

One of the desired functions of shampooing is to improve wet and dry combing after bathing. To accomplish this, conditioning agents are included in shampoo formulations. Improved brushability and combing offers a two-fold benefit. One, the easier the animal is to brush, the less time the groomer needs to spend with the pet. Second, the easier the brush or comb move through the coat, the less damage caused to the hair during grooming.
Unlike charges attract while like charges repel.

Hair strands have an inherently negative charge. They tend to repel one another, creating a “fly away” condition. Physics 101 tells us that like charges repel and unlike charges attract. Conditioner helps eliminate this condition by neutralizing the negative charge on the hair strands and adding needed oils and nutrient.

Afghan Hound bride with fly-away issue on ears

The following is a summary of the hair and coat condition issues to look, feel and smell for.

Dry coats are often worsened by overbathing and grooming. Dry, thin and overgroomed hair is more susceptible to fly away. Unfortunately, nature works against a healthy coat. Healthy hair has a moisture range between 8-10%. Air, generally, has only 0.5-0.8% moisture. Since there is a large disparity between the moisture level of the ambient air and hair, moisture tends to migrate out of the hair. It is necessary to infuse the hair with moisture retaining ingredients (humectants) that will impede the migration of moisture out of the hair. Moisture is an important element in a healthy coat, since it maintains the volume, flexibility and manageability of the coat. Indoor air conditioning and forced dry heat exacerbate this differential. The lack of moisture, plus a lack of the waxy sebum which keeps moisture locked into the hair shaft, create the perfect conditions for dry, unsightly coat. Dry hair shows up as fly away strands and a dull coat.

There are a number of conditioning and finishing products that can remedy the dry condition. The first step is to rehydrate the coat by using water and humectant-based formulas. A humectant is a hygroscopic substance. (Hygroscopy is the ability of a substance to attract water molecules from the surrounding environment through either absorption or adsorption). In other words, water from the air -- natural humidity -- is attracted to the coat and ends up inside the cortex of the hair shaft.

Greasy Coats

Greasy hair results from a build-up of the natural secretion of sebum. Sebum is not absorbed into the shaft. The touch and look of hair depends on the amount of waxy sebum present. The glands secrete the same amount of wax regardless of the length of the hair. Therefore, short hair with less surface area than long hair tends to be greasier. Infrequent shampooing will cause grease and debris to accumulate. Eventually, strands will begin to adhere to one another and form clumps. Such clumps, left unattended, join neighboring clumps to form “super clumps.” Degreasers solve this problem. Dematting and detangling products may also be needed before the bath. Degreasing shampoos, while they clean well, tend to quickly strip the coat of sebum and other natural oils. For this reason, it is generally recommended to follow a degreasing shampoo with a conditioner.

Strong odors

There are two primary sources of odor: biological excretions and odor-causing bacteria. The former applies to urine, feces, and other such excretions. The latter applies to bacteria that feed on organic matter, breaking down the proteinacious material and generating mal odor in the process. This breakdown process generates odors more distinctive than excretions. With the exception of skunk spray, excretions are easier to remove. Different additives enable shampoo formulations to focus on excretions and bacteria.

The primary carriers that enable the adsorption process are physisorption and chemisorption. In physisorption, the attraction is so great, different, yet similar to the micelle cleansing action, that the cell walls are penetrated. With chemisorption, an actual bonding is made prior to being carried away. Antimicrobial additives are included in some formulations to prevent the breakdown of proteinacious matter by bacteria that results in mal odor. These additives use an electrochemical action to penetrate and disrupt cell walls of micro-organisms. Having faced many odor issues, the fragrance industry recently has developed ingredients that tend to neutralize offensive odors. While neutralizing mal odors, these ingredients are capable of supporting pleasant odors. Not only do they leave the hair free of
offensive odors, they impart a pleasant fragrance to it. Odor removal, like suds or foaming, is separate from cleansing. Strong surfactants are not the key to odor removal. Oxidation and reduction agents are the major factors in removing odors. Antimicrobial additives include Triclosan and benzalkonium chloride.

**Dull color** is counteracted with special shampoos that feature optical whiteners or optical brighteners. White coats can be made brighter. Black coats can be made to appear darker and richer. Multicolor coats can also be enhanced and their color contrast improved.

**Thin hair** needs shampoo formulations with bodifying agents. Thin hair is often too soft to manage and stay in place. Bodifying ingredients add texture by leaving small deposits on the cuticle, allowing for added rigidity. Bodifying shampoos are formulated to give the coat the appearance of fullness. This can be accomplished in several ways. By infusing the hair shaft with water, each hair shaft swells and appears wider. The multitude of hair gives fullness to the coat. Certain polymers are film-formers and deposit a film on the hair shaft. The film allows the hair to be spaced further apart to give the impression of fullness.

**Colloidal Oatmeal**

**Shampoo therapy** has been proven to have positive clinical outcomes on a number of skin conditions. Industry experts speculate that as many as 20% of dogs and cats have allergy induced skin problems. Skin diseases can be treated by diet and special use shampoos. Such shampoos have active ingredients that alleviate inflammation, calm, soothe (analgesic), and reduce microbial and fungal activity. These shampoo formulations are often referred to as “medicated” shampoos.

Chlorhexidine gluconate, Miconazole, and Benzoyl Peroxide are some of the active antimicrobials in medicated shampoos. Alternatively, natural ingredients such as melaleuca alternifolia (tea tree oil) are also an effective antiseptic and antifungal ingredient. Other natural ingredients include sulfur, coal tar, oatmeal, meadowsweet, and comfrey, salicylic acid, lavender, chamomile, yucca, aloe vera, vitamin E, and a host of other additives.

Professional pet groomers, working predominantly with concentrated formulations, need to first ensure that the shampoo is diluted according to label instructions. Sulfur is known to alleviate various conditions, such as psoriasis and eczema. Zinc pyrithione has antifungal and antibacterial properties that aid in the treatment of dry, flaking skin. (dandruff in human cosmetics).

Coal tar is an antiseborrheic, antidandruff agent. Coal tar will reduce the production of skin cells and treat skin disease and dandruff. Coal tar, used for relief of flaking, generally has a discernible odor that is objectionable to some groomer.

Oil of wintergreen, a natural analgesic and anti-inflammatory is readily absorbed by the skin, and is very warm and soothing. Oil of wintergreen is a naturally derived methyl salicylate. It is a substance that is related to aspirin (acetyl salicylic acid).

Chamomile is used in ear ointments and to calm and relax. Popular designer herbal teas include chamomile. Oatmeal is the most popular additive for soothing and healing the coat with acknowledgement of its anti-itch properties.

A topic deserved of additional reading relates to fleas. Many insecticidal ingredients used in shampoos have been banned by the EPA. Toxicity leads the list of concerns on products of this type. This is primarily because complex chemicals may accumulate in the groomer’s body. Botanical ingredients, which the body can process in less time, should be welcomed. Such botanical ingredients include derus root, orange oil, cedar wood oil and oil of wintergreen.

**Standard Poodle Male**

**The cost of shampoo per groom.**

While shampoo cost is quite high, the actual cost per bath is relatively low. One must pay attention to concentration ratios. For example, a single gallon 16:1
dilution shampoo will bathe twice as many dogs as a product with a lower 8:1 ratio. For example, if two shampoos are being considered, each with a price of $20.00 per gallon, the cost per diluted gallon of the lower ratio (8:1) becomes twice as high as the 16:1. Specifically, the diluted 8:1 works out to $2.50 per gallon, while the 16:1 ratio becomes only $1.25 per gallon.

If one were to arbitrarily assign a nominal 12.8 ounces of diluted shampoo per bath, the cost of shampoo would be 12.5 cents for the 16:1 and 25 cents for the lower concentrate (8:1) shampoo. It is clear that one of the smallest costs of the grooming process is the shampoo. For this reason, high quality products that are suited to the pet’s specific requirements should be specified on a case-by-case basis.

How spending more money reduces overall costs

With the understanding that the cost of shampoo per bath is measured in pennies, not dollars, it follows that conditioner, dematting and fast blow drying products, which are universally available from most manufacturers, add the same cost (about 15 to 30 cents) per groom.

An upcoming article will examine how groomers can spend 20 cents to save 20 minutes.

References


Williams, Daniel J. “A comparison of surfactants in the laboratory with respect to viscosity.” EZ-Groom Internal Publication May 12, 2006.

