How Hair Conditioners Work

MAKING COSMETICS

Hair conditioners mean different things to many people, and there is no universally valid definition of the term “conditioner” available. Most cosmetic manufacturers agree one or more of the following modes of action are characteristics for a hair conditioning product (see table 1).

While there are a large variety of conditioning products on the market including shampoos, rinses, creams, balsams, and hair masks, the most common physical form for a conditioner is a thick, opaque, creamy liquid. See table 2 to see the basic raw materials needed to make a “standard” conditioner.

Cationic Surfactants

The most common principle of active ingredients in hair conditioners is quaternary ammonium compounds (= quats). Quaternary means the ammonium (N) and has four chemical groups attached. Quats can be thought of as ammonium salts with hydrogen molecules replaced by alkyl groups. The anion is usually chloride.

A quat’s ability to condition comes from the hydrophobic (water-repelling) nature of the long C-H-tail and the positive (cationic) charge of the N-group, which is attracted to the negatively (anionic) charged proteins of the hair. This electrostatic interaction, coupled with the fatty nature of long C-H-tail, inhibits rinse-off and makes the hair cuticle smooth, soft, and lubricious. As a result, the hair can be combed much easier and fly-away is largely reduced due to the neutralization of the static electrical build-up.

The fatty chains (C-H-Tail) are derived from various oily components as coconut oil, castor oil, canola oil, and more. The longer the fatty chain, the more lubricant the quat. For dry and damaged hair, quats with long or multiple fatty chains are preferred (behentrimonium or propyltrimonium).

Drawbacks of quats include the low water solubility and the poor compatibility with anionic surfactants, which are commonly used as cleansing agents in shampoos. Making 2-in-1 shampoos have stability problems. These difficulties can be overcome by adding a non-ionic co-surfactant (polysorbate-80 or ceteareth-20), which can assist greatly in the stability and solubility of quats.

In summary, quats are the most important active ingredient in hair conditioners, otherwise, they might not be considered a conditioner.

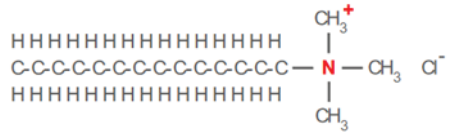
Cationic Polymers

Cationic Polymers are another important group of ingredients commonly used in hair conditioners. Structurally, they are similar to quats as they have many cationic (positively) charged, quaternized fatty alkyl groups per molecule. Polymers are large molecules consisting of a large number of identical units. They may derive from proteins, cellulose, starch, guar gum, silicones, and synthetic sources.

Properties of Hair Conditioners

- Improved wet combing
- Improved dry combing
- Reduced fly-away hair (antistatic)
- Increased gloss and shine
- Increased volume and body
- Improvement of curl retention
- Repair of hair shaft
- Improved moisturization

Table 1



The following is a typical quat is cetyl trimethyl ammonium chloride.

Ingredients for Hair Conditioners

- Cationic Surfactants
- Cationic Polymers
- Bodying Agents and Thickeners
- Emollients
- Auxiliary Emulsifiers
- Fragrances
- Preservatives

Table 2

As with shampoos, conditioners are precieved to be effective when thick and creamy.

One of the most commonly used oils in conditioners is olive oil.

Once deposited to the hair, cationic polymers provide hair with slip, manageability, and good combability. They also increase body and volume in damaged hair and can improve split ends. One example is soy quat that consists of fragmented (hydrolyzed) proteins. It will attach firmly to the hair shaft and form a protective layer on the hair cuticles. Soy quat is often used to treat split ends. Another advantage of cationic polymers is they can overcome the tendency of some quats to leave the hair greasy.

In most cases, cationic polymers and quats can be freely mixed to get the best of both compounds, and no additional emulsifier is usually needed.

Bodying Agents and Thickeners

As with shampoos, conditioners are perceived to be effective when thick and creamy. This is usually achieved by using fatty alcohols (cetyl alcohol), waxes (carnauba wax, paraffin wax), or gums (guar gum). Cationic formulas can also be thickened by adding salt (sodium chloride). To avoid irreversible breakdown of the solution, salt should be added in very small amounts, as a dilute salt solution (10% max), and very slowly with constant stirring.

Emollients

Increased gloss, shine, and improved combing can not only be achieved with cationic quaternary agents, but also oily compounds. Such emollients usually include natural or synthetic oils, along with esters and waxes. The conditioning effect of oils comes from their hydrocarbon nature as they spread easily onto hair shafts, leaving transparent, water-repelling films. These films improve slip, shine, and softness of hair. Natural oils used in conditioners are jojoba oil, olive oil, or grapeseed oil. The most frequently used synthetic oils are silicone (dimethicone), which is even superior to natural oils in terms of film formation, shine, and luster.

Auxiliary Emulsifiers

Quats themselves have emulsifying properties, but often not enough to make a stable solution. An additional emulsifier is often added and it's important that it's a non-ionic, rather than an anionic emulsifier. Anionic emulsifiers are usually incompatible with cationic quats. There is a large variety of non-ionic emulsifiers to choose from, but ethoxylated fatty alcohols (polysorbate-80 or ceteareth-20) seem to be particularly effective. Nowadays, there are even more premised quat/emulsifier combinations available. For example, our CreamMaker CAT combines behentrimonium (quat) with cetearyl alcohol (emulsifier).