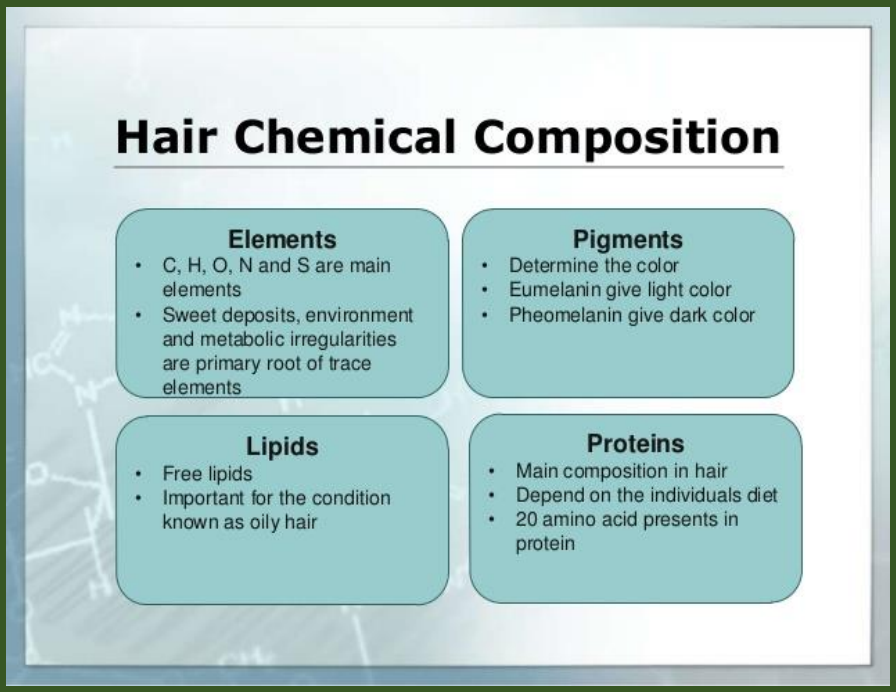
CERTIFICATE IN ORGANIC HAIR CARE FORMULATION.

CHEMICAL COMPOSITION OF THE HAIR AND HAIR STRAND PENETRATION.

The overall chemical composition of hair is 45% carbon,28 %oxygen, 15% nitrogen, 7% hydrogen, and 5% sulfur.

The hair mainly consists of proteins, lipids, water, trace elements, and pigments. The hair shaft is composed explicitly of keratins, which are unique proteins characterized by a very high sulfur amino acid (about 15% cysteine).

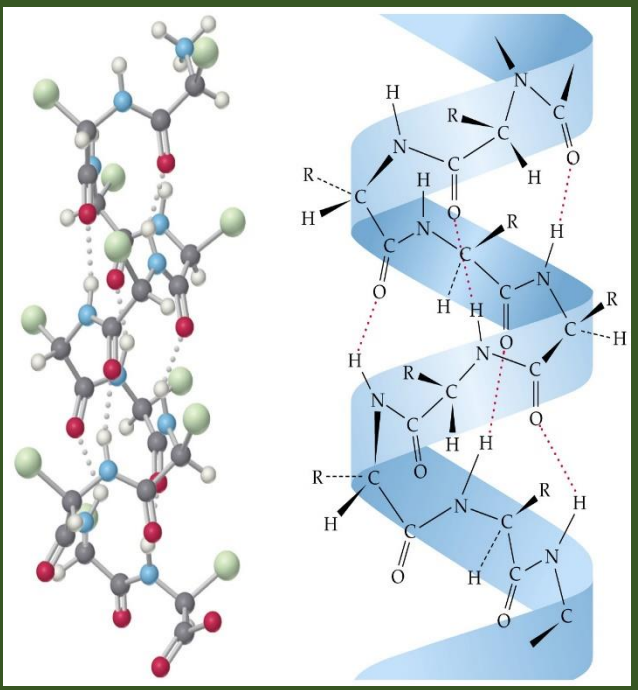


The hair water in the hair is 12-15% and traces mineral elements like calcium, cadmium, chromium, copper, zinc, iron, and silicon. These elements can be drawn to the hair follicles' base by blood circulation and then contribute to the building in the hair shaft.

The hair also contains 3% Lipid components produced in the hair bulb from sterols, fatty acids, and ceramides. The cortex and the cuticle's intercellular cement provide the hair with an absolute impermeability and ensure the cohesion of the hair fiber.

The protein in our hair has a natural affinity with water, which is why the hair can absorb large amount of water- potentially as much as 30% of its dry weight. Different hair types absorb additional water; in other words, our hair absorbs more water than oil, given the innate

affinity its keratin structure has with water. Keratin absorbs 40% of its weight in water which is influenced by higher temperatures changing the pH of the formulation of hair by using polar solvents which breaks down hydrogen bonds.



Once the hair absorbs water .it changes the elasticity of the hair strand and becomes a stretcher.
The hair strand can swell up, potentially increasing as much as 10-15% in diameters and 0.5-1% in length. An alkaline pH will also encourage water absorption and consequent hair strand swelling. This swelling explains why some hair is more massive when they come out of the shower; having wash the hair, water sit in between the hair strands, the hair strand has also absorbed water and swollen in diameter and length. The hair is then dried to dehydrate the water that has been absorbed and becomes lighter in texture again.

CHEMICAL PROCESSED HAIR.

When we apply hair relaxer, straightening or coloring, we'll see some damage in our hair.
All chemical processing leads to a chemical change in our hair, leading to an increase in fiction. Chemical processed hair is affected more when your hair is dry, straighten, or curled; it can even break off the weak points in most cases. Chemically processed hair tends to be more hydrophilic than virgin hair, which attracts water, which is a normal good thing.

Water = moisture, but this can lead to cuticle lifting, which can cause more mechanical damage. We know conditioning is a huge part of keeping our hair in good

condition. Still, when our hair is hydrophilic, our lovely oils, silicones, and conditioning agents aren't attracted to our hair and won't stay there as they're looking for a hydrophobic surface. So, we need to increase the amount of conditioner we use and change some ingredients to include more water-soluble ingredients like hydrolyzed proteins and panthenol (which is why damaged hair likes the intense conditioners – the more conditioning agents, the more is likely to absorb to your hair strand)

HOW TO OPEN HAIR CUTICLES?

These are the factors responsible for opening the hair cuticle and encouraging penetration into the hair strand.

HEAT

Repeated cycles of wetting and heating of the hair can cause multiple cracks on hair cuticles. This damage to the hair cuticle then allows for penetration into the hair strand; for that reason, natural air is drying is often considered to be better for the hair in preventing damage, as is avoiding excessive styling by heat with irons or curling devices. Nonetheless, one study put forward the hypothesis that a long-lasting wet stage can be as harmful as a high drying temperature.

PH.

An alkaline ph can increase the negative electrical charges of the hair strand's surface, which then increases friction between the hair fibers; this friction is thought to cause cuticle damage and hair strand breakage.

SOLVENT

Polar solvents break hydrogen bonds. Usually, the hair is resistant to swelling because of the existence of these bonds
which maintain the hair strand; however, when certain polar solvents such as urea solutions, acetamide, and lithium bromide come into contact with the hair, they encourage swelling, which allows the penetration of water and other ingredients into the hair.

HAIR POROSITY.

Porosity can be defined as how the individual hair strands retain moisture. Being porous means that the hair is permeable to
fluids in general, hair falls into one of these categories.

TYPES OF POROSITY.

LOW POROSITY HAIR
AVERAGE POROSITY HAIR
HIGH POROSITY HAIR.

LOW POROSITY HAIR.

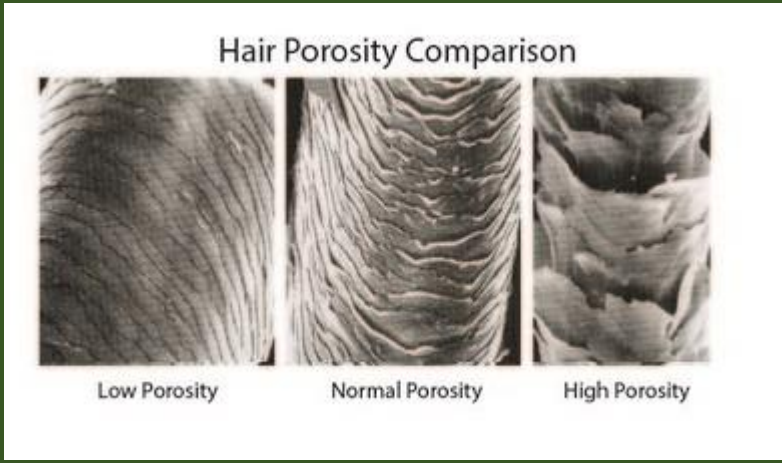
In this case, the cuticles act as a substantial barrier to penetration of ingredients, including water. It is also challenging for the hair to lose moisture. Water, oils, conditioning agents, and active ingredients struggle to penetrate the hair strand. Moisturizing the hair will be challenging as ingredients don't quickly get into the hair strand's inner layer. The scales of the cuticle overlap each other and are tightly bound together. Low porosity hair will feel very smooth when you run your fingers along the hair strand. The cuticle is intact and tightly hugs the cortex.

CHARACTERISTICS OF LOW POROSITY HAIR

- The cuticle is tightly packed together.
- The hair strand feels shiny to touch
- The cuticles act as a barrier to ingredient penetration.
- It is hard for the hair to lose moisture.

- It is hard to color the hair strand
- Products might sit on top or build upon the hair
- Water might bead up on the hair
- Use heat to open up the cuticle
- Formulate light products, potentially high in humectants.

AVERAGE /NORMAL POROSITY.



Average/Normal porosity is between low or high porosity. Hair with average porosity sometimes feel perfectly moisturized and sometimes feel dry, but the hair moisture itself is relatively easy to manage.

CHARACTERISTICS OF AVERAGE POROSITY.

-The cuticle shows some gap
-The hair strand will feel somewhere between smooth and rough
-The cuticle allows some ingredients to penetrate
-Hair can be dry, but moisture is easy to manage.

-It is not difficult to color the hair strand.
-Products penetrate the hair strand over time and can benefit from leave-in products.

HIGH POROSITY HAIR

The cuticle is not closely packed together, and the scales don't overlap quite tightly. The hair will feel
rough when you run in between your fingers. The cuticle is effectively raised, so there are more gaps in the cuticle. The simplest way of looking at high porosity hair is that ingredients can pass through the hair strand quite quickly ingredients go in and then come straight out the other side again. Tall porosity hair can look and feel quite dry and dull.

This type of hair dries quickly because it doesn't retain moisture easily and tends to be quite frizzy and prone to tangling.

Deep conditioning or heavy products will work well with high porosity hair as they will seal the gaps in the cuticles and help retain moisture.

CHARACTERISTICS OF HIGH POROSITY HAIR

-The cuticle shows a gap
-The hair strand will feel rough
-The cuticle easily allows ingredients to penetrate
-Hair can be dry and dull.

-It's easy to color the hair strand
-Products go straight through the hair strand.
-Use deep conditioning or heavy products to add moisture.

OILS PENETRATION INTO THE HAIR.

Certain vegetable oils have been found to penetrate the hair strand; they can turn down the amount of water sucked into the hair, leading to lower swelling of the hair strand. The process of the hair repeatedly swelling and drying is known as HYGRAL FATIGUE and can cause lasting damage. Just as high porosity hair can absorb a large amount of water, which could even potentially damage it, in this case, oil can be highly beneficial to the

hair to protect it before washing. Certain low molecular weight surfactants such as sodium lauryl sulfate (SLS) can penetrate easily into the hair structure. They can interfere with hydrogen bonds and salt linkages, which can weaken the hair. When applying oil to the hair and scalp, this oil can fill the gap between the hair and the follicle walls, which prevent the penetration of the solvent solution into the follicles.

Surfactant molecules such as SLS can lead to the hair's loosening in the follicles, which could ultimately lead to hair loss. This

The Negative effect is why the mainstream industry instead uses sodium laurate sulfate instead of SLS. Applying
regular oil application, therefore, prevent follicular damage leading to hair loss. The potential penetration of oil into the hair depends on several factors. Saturated and monosaturated fats diffuse into the coat easier than polyunsaturated oils, those oils with at least two double bonds such as linoleic acid, linolenic acid, gamma-linolenic
acid, in other words, not all fats are equal when it comes to hair strand penetration. Coconut oil appears to be one of the best oils for hair strand penetration and is best

known for its ability to penetrate the hair because it contains a high percentage of lauric acid. It has a high affinity for the protein in the hair. It also has a low molecular weight and straight linear chain, which most polyunsaturated oils don't. Coconut oil can penetrate the cortex itself; once it gets there, it can prevent the hair's loss of protein.