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Science-based hair care - and more.

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Saturday, July 20, 2013

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pH and Your Hair. A little redox to make you happy.

Here's what I know and what I think about pH and hair products. This is "redox" chemistry (oxidation and reduction). One of my teachers said to our class, "Next week, we'll be doing redox," followed by an evil laugh. I love it because it applies to so many living systems we work with every day. I think you will too.

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Get ready for a chemistry smackdown on hair cuticle folklore. Forget all that stuff you've heard about cuticles being open or closed as a result of different pH. Cuticles being "open" when it is the result of a solution you put on your hair is a *side effect* of hair swelling in the wrong pH, in strong detergent, or in just plain old water if it's wet for too long. Likewise for cuticles being "closed."

The shortest story possible: If you do not want to suddenly damage the structure of your hair in an irreversible way - keep it out of solutions with a of pH 3 or under, and out of solutions with a pH 9 or above. Especially do not leave your hair in these solutions for a long time. For that matter - keep those sorts of solutions away from your skin and eyes also!

pH 3-9

These extremes will tend to cause the hair to swell, take on acid or base, and structural damage is the result.

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Examples of things you might want to avoid putting in your hair to avoid those extremes: pH 2 is undiluted lemon juice, straight vinegar can be pH 3, so can soda drinks. Why you would put soda in your hair, I don't know. But you put it on your teeth when you drink it, which I find disturbing. To get to pH 9, you need (diluted) sodium hydroxide, lithium hydroxide, potassium hydroxide, or guanidine hydroxide used in hair relaxers or ordinary soap (the kind made from fats and lye).

If you remember one thing from this blog post:

Rinse-out products are safest for hair between pH 4 and 6.

Leave-on products are safest for hair between pH 5 and 6 (or 4.5 and 6 for bleached or lightened hair).

Treatments which use heat or are meant to be more than superficial are safest between pH 5 and 6.

To prevent sudden and irreversible damage to hair, stay between pH 4 and 9.

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The slightly longer story

Keep in mind that products marketed to the entire family are assumed to have contact with eyes, nose, and mouth during use and when rinsed off. So a neutral or near-neutral pH around 7 may be ideal for safety reasons.

You also need to know that certain preservatives are more active in a specific pH range. That means that the product pH needs to be kept tightly within a specific pH range to assure the preservative will work well and continue to work for the full anticipated shelf life.

These non-hair considerations are a big deal because irritating people's eyes and noses and mouths is dangerous and potentially litigious, and choosing a preservative which will work with the variety of ingredients in a product and stay stable for 1-2 years is one of the more difficult aspects of product formulation.

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Electric hair

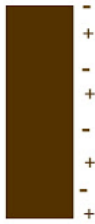
Your hair is mostly protein and oils and water (if you ground it up and measured what is in there - that's what you'd find). Those things carry charges - positive or negative. Hair tends to have a greater number of negative charges when you're running around during your day. We're dealing with the surface of the hair because that's where these solutions mostly act. Once hair has swollen in an inappropriate pH solution, you begin acting on the interior structure. Bad news!

Charge is sometimes pH-dependent. If you move an item from an acid environment to an alkaline or basic environment, it will switch to an opposite charge as it gains or loses electrons to the environment. It's electrons that represent charge in the first place.

Hair (proteins and smaller particles) have an "isoionic point." That is the pH value at which it is in balance between positive and negative charge - there is no "net charge," the same number of positive charges and negative charges exist at the surface. Your hair is taking up neither acid nor base from the solutions it is in contact with. It's stable under these conditions. Everything is groovy.

If you put your hair in a solution lower than 5.6-6.2, such as vinegar or lemon juice or a citric acid rinse, it will take on acid (that's protons or + charges). If you put it in a solution higher than 5.6-6.2,

it will take on "base" or OH- charges. That's right - when you use baking soda-water on your hair and it feels extra-soft, it's soaking up base and taking on that slippery, slimy feel shared by many bases. Shifting the electrostatic charge on your hair takes a toll because you can't do that without altering the chemistry of the proteins and oils that make up your hair in some way.



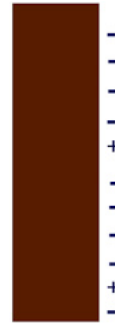
Hair at its isoelectric point between pH 5.6 and 6.2. Positive and negative charges are in balance.

What is healthy hair's isoionic point hair? Around pH 5.6 to 6.2.

But there's more! Has your hair been oxidized by bleach (highlighting, permanent dye, swimming pools) or by the sun? In that case the isoionic point *decreases* because oxidation changes the chemical composition of the surface of your hair. You might be able to go a little lower in pH - and benefit from it. This is one reason why products for color-treated hair often have a lower-than-neutral pH and are marketed based on that feature.

So what!? We rinse a lot of these products off in pH ~7 water, right? Yep. Though even brief, repeated extreme pH insults would still be a bad idea.

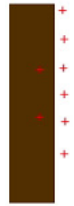
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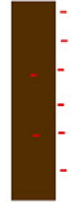
Brown rectangle is a hair, at right the net charge is negative because there are more negative charges than positive ones.

So why are some products formulated with a lower-than-5 pH?

Because bleached hair can go lower, and many people's hair can potentially tolerate a lower pH if they are quick about it. That's where the isoelectric point (different from "isoionic") comes into the equation. Your hair's isoelectric point is way down between pH 3.4 and 4.5. Isoelectric means the hair temporarily has zero charge. If you read about these things online or in the popular media, you will encounter the idea that a quite-low pH product, having knocked the charges away, leaves your hair with tightly-closed cuticles and therefore very resistant. That is not an



pH 5 or below, + charge (acid) enters hair to "reduce" hair. Hair is unstable, swelling and protein or oil loss will occur if this condition persists.



pH above 7, especially above 8. Hair takes on more - charges and is oxidized. Hair will swell and experience severe damage if left in solutions above pH 9.

adequate explanation for me! I prefer to think of it as the point at which your hair is "non-reactive." Non-reactive refers to what happens between hair and things you put on your hair. "Tightly closed cuticles" implies that once you close them, they cannot be opened like a locked door. Or something. It doesn't hold up to scrutiny, such as the question, "Okay, but then what will keep them closed?"

Below pH 5, acids enter the hair if left on hair for a long time. Hair loses its charge balance. Above pH 7 to 8, "base" enters hair. The - and + charges above show how these charges are added by the solution - it's a visual aid, not an absolute reflection of the whole oxidation/reduction picture.

We must ask ourselves - if the hair is charge-free, how will it bond to cationic-charged conditioners for better slip? Indeed, it seems that cationic conditioners are more strongly adsorbed to hair (adhere more firmly) *above pH 3.7*. You need some negative charges on there, people! *A lower-than-4.5 pH would be completely counter-productive in a cationic conditioning product.*

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The take-home message:

For short-term, superficial treatments like shampooing or conditioning or rinses the isoelectric point sets the very bottom limit: Below pH 5 your hair is out of balance, but not necessarily in danger. You're not going beneath the surface of hair with these treatments and they are short-lived. Stay above pH 4 and below pH 6 and you're in good shape. For a pH 4 or 4.5 hair product (like a gel) that will take many hours to dry in your hair - that might be a problem. It's still superficial or a surface-only treatment, but the length of time it stays wet and therefore active might cause problems. Probably better to be around pH 5.5 for that, unless you have lots of highlights or bleaching with hair dyeing.



Hair with net negative charge binds to positively charged (cationic) conditioner in an appropriate pH solution.



pH less than 4.5 (between 3.4 and 4.5), hair has "zero" charge and cationic charged conditioners have little to bond to, thus are not substantive.

Representation of conditioner bonding to hair based on the attraction of opposite charges (left). Pink + charges at right represent conditioner not bonding to hair at pH values below 4.5 when hair has a "zero" charge.

It's those longer-lasting and more invasive treatments like permanent waves, hair bleaching, high-heated treatments in which you *absolutely must* keep hair in that 5.6-6.2 range, especially because it's not just the surface you're dealing with - perms and bleaching are deeper than the cuticles. Hence the "acid perm."

Why does my hair not respond well to acidic rinses?

So if low-ish pH isn't necessarily evil to your hair, then *why can vinegar or citric acid rinses leave hair feeling dry and rough?* Let's say your hair is porous (even if just the

ends are) - those solutions with a less-friendly pH get into your hair more easily and have access to a lot of surface area. You just got a bigger dose. Acids have corrosive action - they donate those "+" charges that lead to rusty metal. Acids can dissolve things like calcium. Acids can destroy fats and proteins. Think of what happens if you put lemon juice in milk (it curdles). Or if you put a nail in a glass of Coke. Weak acids like vinegar or citric acid can strip off some surface oils and proteins. Acids may interact with your water, with the mineral deposits on your hair, the ingredients in your products. The possibilities are endless. There's nothing wrong with an occasional vinegar or citric acid rinse as long as they're diluted properly but chemically, it can be a wild card.

Some people have very resilient hair that can tolerate acidic rinses whereas other people's hair will swell and take on acid immediately. Some people's hair can tolerate acids but not bases. Everybody's hair is different for so many reasons.

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Test pH at home:

Get yourself some pH strips in the aquatic pets section of a pet store or the swimming pool section of a department store, or from your local drugstore. Make sure they measure below pH 7 as well as above. Test your homemade rinses and adjust accordingly. You can test other products also. Conditioner often gives a less-than-accurate reading because it's not all liquid (there are fats in there). But you can get a rough idea.

What you do with this information is up to you. In my world - if I wanted to chemically relax my hair, I'd do it and hope it didn't eat the skin on my scalp. If I wanted to wash it with bar soap, I would do that (but no thank you to the soap scum). And I'd be armed with the knowledge that my hair had been chemically altered and therefore I would need to give it extra gentle care. If you want to use a citric acid or vinegar rinse - go for it. If it's too strong the first time, whip out your pH strips and find a pH your hair can tolerate.

Chemical and Physical Behavior of Human Hair

Robbins, 1994. 3rd Ed. Springer-Verlag, New York



Posted by WS at 5:38 PM 12 comments:

Labels: acid, alkaline, baking soda, base, citric acid, pH, soap, vinegar

Friday, August 12, 2011

Preserving Your Homemade Hair Gels

If you make homemade hair gels (I won't discuss other products right now because ionic-charged ingredients in conditioners or shampoos makes preserving more complicated), and you do not store them in the refrigerator – or if you usually do, but are going away from home, then you need to think about preservatives. This refers to flaxseed based gels, vegetable gum based gels (guar gum, xanthan gum), aloe based gels, or any other vegetable-based gel (psyllium, okra...).

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How Can A Product Go Bad?

Rancidity can happen to oils (aka oxidation) if you use them. ©Science-y Hair Blog 2013

Bacteria or fungi can grow, using the sugar and nutrient-rich gel for food, also excreting their metabolic wastes into the gel causing cloudiness, fermentation, changes in thickness and texture and odor.

These are the biggies, not only because they ruin your gel, but because the bacteria (or fungi) growing in your un-preserved, un-refrigerated gel could be pathogenic. Let me get up on my soapbox for a moment. We need not fear bacteria everywhere. Every bit of our bodies is permeated with bacteria and other critters and without them, we would be weak, sick, malnourished and completely different than we know ourselves to be. Having said *that*, bacteria on your skin, in your guts are not usually making you sick. But if you get a cut, then there's an opportunity for an infection. If bacteria end up where they should not be, or if they have a chance to colonize a medium and grow like mad (or even form self-protecting biofilms like plaque on your teeth) – then you've also got a problem. So if your hair gel turns into growth media for bacteria and fungi and it gets on your hands and then in your eyes, on a tiny cut, in your mouth etc., it's a problem. Especially for gels based on food-quality items. I found bacteria from the *Staph/Strep* families, and others which would be food-borne pathogens in un-preserved, un-refrigerated, homemade hair gel. ©Science-y Hair Blog 2013

If you want to preserve your flax-based or gum-based gels, there are some safe, easy ways to do this. I have tested some preservatives, and my data have been added to by some other people with preservatives I have not yet tested. I began with 2 bases, one was flaxseed gel with agave nectar and hydroxyethylcellulose, the other had olive oil added as well. For each gel, one sample was refrigerated and one was left at room temperature. I did a un-preserved control too. I used a Gram-stain test to detect bacteria in the gels as they were. This is a different method than used by cosmetics companies - but it gives us a rough idea of how our preservatives are working. ©Science-y Hair Blog 2013

Preparation Notes: Even if you're refrigerating your gels, it's best to use *distilled water* to prepare them (no chlorine or minerals) and to wipe down all your utensils and nearby surfaces with rubbing alcohol. Remember, this isn't just "cooking," you're planning to keep using this for longer than a week – you need to be careful! Put your gel in a bottle with a lid. If it's in a cup where you'll be sticking your fingers into it, you dramatically increase the potential for contamination. And spilling (trust me about the spilling bit). ©Science-y Hair Blog 2013

Why are preservatives given as percentages? That's the best way to measure. If you need 0.5% (half of one percent) preservative, that is 0.5 grams per 100 grams. Or 1.25 grams per cup (250 grams). 1.25 grams is one *full* quarter teaspoon (1/4 tsp) per cup of gel. You will have a much more accurate preserving experience if you weigh your gel, do the math, then weigh your preservative accordingly. It is difficult to weigh out grams on an inexpensive kitchen scale - you need one that reads at least "0.00" or gives you 2 decimal places.

Here is the math: weight of gel in grams x % preservative recommended by manufacturer in decimals. For example, your gel ends up weighing 236 grams and you're using 1% preservative. Multiply 236 x 0.01 = 2.36 grams.

If you must "fudge" and use measuring spoons (approximate measurements, you will probably not get exactly this percent using a measuring spoon):

1/4 teaspoon per full cup = 0.5%

1/2 teaspoon per full cup = 1%

Ideally, we subtract the weight of each additive from the total when formulating products (add one gram preservative, subtract one gram gel). If your product goes funky because the measuring was off - don't say I didn't warn you. Just don't use it! And if you make a product to give a friend or family member - please use a preservative. Friends don't let friends use contaminated hair gel.

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The scorecard (hits, misses, and so-so):

Hit!

Preservative: Refrigeration: Regardless of the additive (agave nectar, oils, protein, thickeners), refrigeration for up to 2 weeks prevents or effectively inhibits the growth of bacteria and fungi to the point at which they are scarcely present. If you don't use up a batch of gel in 2 weeks and

you're not using a commercial preservative, freeze half.

So-so (at room temperature):

Preservative: Citric acid (1/8 tsp), potassium sorbate (0.2%), vitamin E (0.2-0.3%): This may work for you, but when I tested it for bacteria, I found small quantities of bacteria and lesser amounts of fungi at 2 weeks time. The gel had begun to look cloudy. The citric acid discourages some species of bacteria, the potassium sorbate inhibits fungal (mold) growth (and you could double the amount of potassium sorbate). But this won't preserve for a long time. If refrigerated, this preservative combination is perfectly adequate.

Hit!©Science-y Hair Blog 2013

Preservative: Citric acid (1/8 tsp), potassium sorbate (0.2%), vitamin E (0.2-0.3%), EDTA (disodium or tetrasodium EDTA) at 0.2%: This appeared to have very good preserving qualities with virtually no bacterial or fungal contamination at 2 weeks at room temperature or refrigeration. EDTA is not only an antioxidant, but it inhibits cell wall formation in bacteria. **2013 update:** The pH of this may be a bit low, start with much less citric acid, adding a little at a time and use pH strips to make sure the pH is above 4.5.

Miss©Science-y Hair Blog 2013

Preservative: Cosmocil CQ (Polyaminopropyl biguanide, 0.5%) and potassium sorbate (0.2%): A very mild (to the skin) preservative which must be paired with another preservative to inhibit fungi (mold). Not a good result. The preservative made the gel look cloudy and thicker from the beginning, and there was a film over the surface at 2 weeks in the un-refrigerated sample which appeared to be mold. I was not able to identify what sort of mold. No bacterial growth was evident, and the percentage of potassium sorbate *could* be increased – but this preservative made an aesthetically and texturally unpleasing product from the start, thus it was a “miss.”

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Preservative: Sodium Hydroxymethylglycinate (0.5%) and citric acid to balance the pH:

There was no evidence of bacterial or fungal contamination in the refrigerated or unrefrigerated samples. The gel was crystal-clear and the preservative did not change the texture or thickness.

A word of caution: this preservative is a potential formaldehyde releaser and may irritate skin which is sensitive to formaldehydes. I can tolerate it, although I cannot tolerate other formaldehyde releasers, so to each their own. This preservative raises pH and it is necessary to bring it back down with citric acid so that it is not damaging to the hair.

Hit!©Science-y Hair Blog 2013

Preservative: Optiphen Plus (Phenoxyethanol, Caprylyl glycol and Sorbic acid, 0.5%):

This preservative may not work well if you use hydroxyethylcellulose in your gels (it may be rendered less effective). I have not tested this for bacteria yet, I am sensitive to this preservative. I have used it in other products and I know of another person who used it in a complex flaxseed gel mixture with no evidence of contamination after almost a month. Contaminated flaxseed gel has the advantage of becoming cloudy at low contamination levels. Optiphen Plus makes thick polysaccharide gels like flaxseed gel slightly less stringy (alters viscosity when added). It is a broad-spectrum preservative effective against bacteria and fungi.

Other preservatives I have not tested (that gets expensive!) which should be compatible with homemade gels so long as you are not adding any commercial conditioners (and possibly cellulose derivatives) are: Tinosan, Phenopip, Germall Plus, Germaben, and Geoguard Ultra.

If your homemade natural hair gel becomes cloudy, changes color, changes odor or viscosity (thickness, texture), throw it out!

On the Go: If you are away from home, no matter how well you've preserved your product, it should not be left in a hot car or in the sun. An exception would be putting a single-use of gel in a small bottle in a gym bag or purse to use *that day*. My travel tip is to bring along a cooler and stash the gel in there (along with food – hey, I travel cheap!) If you are flying or taking a train, you can stop at a store at your destination and purchase a small cooler (even a large, insulated coffee cup will do if you pack some ice around your bottle of gel).©Science-y Hair Blog 2013

A note about additives and grapefruit (seed) extract:

If you use ingredients such as prepared protein additives, these are pre-preserved. But don't count on the preservative in there to protect your product. It may help a little, but it's not enough.

Grapefruit seed extracts have not been demonstrated to be true preservatives. Sometimes they work because of the preservatives added to the grapefruit seed extracts to keep it from going bad (said preservatives are usually not on the product label), but don't trust these products to keep yours from becoming home to colonies of bacteria and fungi. If you want to use grapefruit seed extract, buy it from a cosmetics-ingredient supplier so you are getting a concentrated product meant for preserving cosmetics. If the bottle says it's safe to ingest, it is probably not going to preserve your hair products for very long.©Science-y Hair Blog 2013

Clean Bottles!

When you're done with your gel, if you wish to re-use the container, wash it well with soap and water (and a bottle brush if you have one), then use diluted bleach or rubbing alcohol (or un-diluted white vinegar) to sterilize. Pour a little in the bottle, cap it, and shake it up. Leave the bleach or alcohol in there for 20 minutes, shaking several times during the interval. Run some disinfectant through the cap if it's a flip-cap. Then empty and rinse.

[Here is a link to a post about cleaning bottles for your homemade gel.](#)



Posted by WS at [12:05 PM](#) 66 comments:

Labels: [flaxseed gel](#), [natural hair gel](#), [preservatives](#), [preserve homemade hair gel](#)

Tuesday, March 13, 2012

What's Cookin': Super Smooth Flax Curl Cream

If you have dry or tightly curled or coarse (hair that has a wide diameter) or kinking hair, you might like this recipe! It does wonders for gray hair too. Defines, softens, de-frizzes, holds gently, adds shine and enhances your hair's natural texture.

Warning, Version #1 has one (okay, maybe 2) Uncommon Ingredients. Version #2 does not.

It transforms husband's kinking, mind-of-its-own hair into shiny, soft, well-defined waves and curls that just get better as the day wears on. It makes my more silky hair a little heavy, I cannot use too much of it.

Here's a link to a stronger-hold recipe, if your hair demands more hold: [Flaxseed Curl Cream](#). ©Science-y Hair Blog 2013

Ingredients for Super Smooth Flax Curl Cream:

- Flaxseeds
- Water (preferably distilled)
- Coconut oil for dry or porous hair, apricot kernel or grapeseed oil or a mixture of your favorite lighter oils for easily weighed-down hair.

Variation #1: BTMS-25 or BTMS-50 flakes (BTMS contains Cetyl alcohol and Behentrimonium methosulfate, an ingredient used in formulating hair and skin products. If you use this ingredient, make sure it does not contain ingredients other than the 2 mentioned - check with the manufacturer or supplier).

OR

Variation #2: A creamy, thick hair conditioner of your choice, thin or runny conditioners may not work as well.

Both variations: - *Optional, not necessary:* Add a tiny pinch - about 1/32 of a teaspoon citric acid or "Fruit Fresh" to make a lower pH product, Ideal for porous, dyed or highlighted hair.

- Hydrolyzed protein (*optional, some hair types may feel too stiff or become dry and brittle with protein added*) such as Colorful Neutral Protein Filler

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Step 1: Make the Flax Base (Variation 1 and 2)

Boil together 3 tablespoons (1/4 cup) flaxseeds and 1 1/2 cups distilled water, stirring occasionally, for about 5-6 minutes. The flax should be sinking and the gel should be starting to look like thin threads as it drips from your stirring spoon or fork, but it should not fall in thick strings. (Optional: soak the flaxseeds in the water for about 3-6 hours before boiling for a stronger-textured gel).

Strain the seeds out of the gel with a colander or wire strainer.

You should have about 3/4 to 1 cup of gel (if not, use more water from the beginning next time and for now, put the gel back in a pan, add enough water to equal 1 cup and re-heat and whisk).

Step 2 and 3, Variation #1: Meanwhile, in a double boiler (such as a Pyrex measuring cup in a double boiler or in a pan on a rack) heat 1/2 teaspoon coconut oil (or other oils) and 1/4 to 1/2 teaspoon BTMS (Cetyl alcohol and Behentrimonium methosulfate - a cationic, emulsifying conditioner) just until it melts, lower the temperature on the stove and hold at 140° F (60°C) for 15 minutes (for example - while you boil the flax seeds).

After that 15 minutes is over, add the flax gel and optional citric acid if using to the double-boiler in which you have melted the oil and conditioner. Blend well with a stick (immersion) blender.

Steps 2 and 3, Variation #2: Directly to the strained flax gel add 1/2 teaspoon coconut or other oils so that it melts. **Then let the gel cool until it's comfortable to touch.** When the gel is cool, add 2-3 tablespoons conditioner, optional citric acid if using and whisk well, or use an immersion (stick) blender or an ordinary blender to mix gel, oil and conditioner.

Optional protein step: When cool enough to touch, add 1/2 teaspoon hydrolyzed protein such as Colorful Neutral Protein Filler, or hydrolyzed protein of your choice.

Step 4: Pour into a clean, sterilized bottle with a cap (it's still slimy, this is the best way to dispense it) and refrigerate - this should keep for 2 weeks. You can freeze part of the gel for a longer "shelf" life. Clean jars work well too - scoop the gel out with a clean spoon instead of your fingers to avoid contamination.

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Too thin and slippery? Need more hold? This recipe is rather thin and slimy. To thicken the gel and add a little more hold, do this before you add anything else to the gel.

Mix any of these thickeners with 1 tablespoon cool water to dissolve or disperse:

1/2 teaspoon pectin - the kind for making jam and jelly *without sugar* but watch that the pH doesn't go too low

or

1/2 teaspoon xanthan gum

or

3/4 to 1 teaspoon arrowroot starch (flour) or cornstarch

Return the gel to a pan over medium heat (or in a double boiler) and add the thickener-water mixture. Heat the gel while whisking or stirring until the thickener is dispersed and not lumpy - for the starches you want to see the gel get mostly clear and begin to thicken. Use an immersion blender for quicker blending.

To use: Apply to damp or wet hair as you would any hair gel. Top with a stronger-hold gel if you prefer. The flaxseed gel (and protein) provide moisturizing, shine and light hold. The conditioner adds softness and light hold as well as frizz control. The coconut oil provides softness, pliability and shine and helps trap moisture near the hair.

Application tips: For the absolutely smoothest result, comb this gel (with a wide-tooth comb, or your fingers) into your hair or smooth it over small sections, making sure all strands are well-saturated. Then scrunch if you like (*slowly and gently* let hair fall into your palm and press upwards towards your head so that the hair can form it's waves and curls in the palm of your hand, then give a gentle squeeze for 3-5 seconds once it's all up near

your scalp. Just as slowly, release the hair). Blot out any excess moisture and air-dry or lightly diffuse-dry.

To elongate curls: Apply the product to dry hair to style or to refresh.

Trial size: Assuming you already have some flaxseed gel.
 1/4 cup of strained, homemade flaxseed gel (thickened or not)
 1/8 teaspoon coconut oil or grapeseed oil
 1 1/2 teaspoons conditioner

Mix together in a clean container (if the coconut oil has solidified, warm it first). Refrigerate the "leftovers" if you want to use them later.

Enjoy! 

Posted by [WS](#) at [9:51 PM](#) 6 comments:

Labels: [coarse hair](#), [coconut oil](#), [Flax curl cream](#), [homemade curl cream](#), [homemade hair gel](#), [kinky hair](#), [protein hair gel](#)

Sunday, July 13, 2014

Moisturizing Low Porosity Hair

Updated May 2016

Low porosity hair is not necessarily difficult hair or problem hair. It is hair that is easily kept in a *healthy* condition, strong and elastic. It doesn't need a lot of help to keep its integrity, it needs gentle handling and a little personalized care. So why do people describe having a hard time moisturizing low porosity hair, then? What are we missing? Why isn't conditioner the quick path to moisturized hair? Why does oil and conditioner seem to sit on top of your low porosity hair, but soak in for everybody else? **NOTE:** Healthy, low porosity hair may or may not have the cosmetic attributes you find desirable - that's different. That's perception and expectation. You may find your low-porosity hair frustrating because you want it to feel or behave differently whereas somebody else might prefer to have hair like yours.

If your lower porosity hair feels dry, wiry, tangly or brittle it not necessarily lacking oil or conditioner - it's lacking *hydration and flexibility*. Hydrating lower porosity hair takes a different mindset - and a special bag of tricks. If your hair is medium to coarse, it may also need help with *softness and flexibility*, something you get from conditioners and some oils. Look for conditioners thickened with cetyl alcohol to lend softness to your hair.

Don't confuse silky or slippery hair with low porosity hair. That's not necessarily low porosity although it's more likely to be low porosity. Low porosity hair is usually more porous on the ends. Maybe a little more, maybe a lot. Most people's hair is not the same at the roots as it is at the ends. Sometimes it isn't, but usually it is. Don't neglect your ends! Lower porosity hair often needs "porous hair care" on the ends, but a *lot less of everything emollient-y than your all-porous-haired counterparts who can use handfuls of conditioner and oil with reckless abandon*. If your hair takes a long time to get wet - it's not necessarily low porosity. If your hair is very thick or very curly, it takes longer to get wet.

The cognitive process begins with the word "moisturize."

Moisturize: A catch-all term. Moisture is water. Not conditioner, not oil. You don't drink oil when you're thirsty.

Hydrate: Provide and maintain adequate water. Ah, now this is what your lower porosity hair needs! Hair contains water. Well-hydrated hair is more elastic, more flexible, and less frizzy or fluffy than dehydrated hair. Hydration is all about water in and around your hair. [Here's a post with more information about how much water your hair holds within the fiber.](#)

Low porosity hair is what we all have coming out of our scalps. But for some people, it tends to stay low porosity as it grows and only rough handling combined with exposure to hair-lightening bleach (peroxide+high pH) or swimming pools or salt water and lots of sun over years can make it porous. For some, hair becomes porous by the time it reaches your chin or shoulders. But whether or not it *behaves* as though it is porous is a different story.

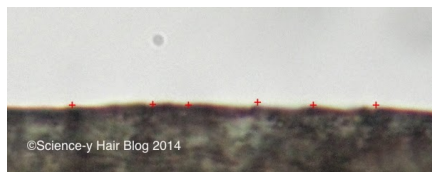
Low porosity hair and/or silky hair may run in families. And so does hair behavior that may help keep your hair from becoming porous - good hair care, an outdoorsy lifestyle, you get the picture. Any texture hair can tend to be lower porosity and any hair width, fine (narrow), medium or coarse (wide) can be low porosity.

Low porosity hair has cuticle scales that lie tightly against the surface of the hair. **Low porosity hair is hydrophobic - it repels water from its surface.** It does not readily allow water in (when immersed in water), nor does it readily lose the water that is contained within the hair - it does not dehydrate quickly from its internal material. That doesn't mean it won't get frizzy or limp in humidity or *feel* dry and tangly. It also doesn't mean it feels soft and flexible - **hydrophobic** simply means that lower-porosity hair does not exchange water with the environment quickly. Low porosity hair can dry out in sun and wind and with lots of swimming or high-heat styling or bleaching (highlights). Low porosity hair may be more resistant to hair dye and other chemicals as well, but only if you handle it gently and don't expose it to multiple insults; for example permanent hair color + high heat styling. Or lots of summer sun + swimming in chlorinated pools or salt water. Wear that swim cap.

Lower porosity hair does not have many chipped and broken cuticles sticking up, ready to be broken off with abrasion, thus it tends to remain lower porosity. That also means there are fewer binding sites for cationic conditioning ingredients, which is one reason it is difficult to use standard hair conditioners and get a good result.

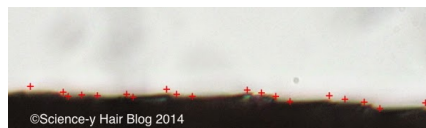
Some people
recommend using





Red "+" signs indicate (roughly) potential binding sites for cationic hair conditioners in this low porosity, coily hair.

chemicals (baking soda solution, soap bars) to make hair low porosity hair more porous so it can take up more conditioner. This is something you need to do with caution - try the treatment on at least a 1-inch section of hair and



Red "+" signs indicate potential binding sites for conditioner in this porous, coily hair. There are many more resulting from chipped and broken cuticles.

assess the results before using it on all your hair. From hair that I have tested and blog readers comments, baking soda mixed with yogurt is less aggressive a treatment than baking soda and water and baking soda mixed with conditioner also seems to be less aggressive than baking soda and water. Baking soda mixed into shampoo seems to be more aggressive than baking soda and conditioner.

The potential problem with using baking soda and soap bars and acid to try to moisturize hair:

You'll read online that alkaline solutions make cuticles open and acidic solutions make cuticles lie flat or "close up" too. That is semi-accurate - alkaline solutions force hair to *swell*. As it swells, the cuticles pop up and there is an exchange of solutes inside the hair and alkaline solution that you applied. Everybody's hair is just a little different - not just the fiber itself, but what we've done to it, where we live (water chemistry, sunlight's UV and heat, temperature) and what we've put on it. Is it *really* possible that everybody's hair will display the exact same behavior in acidic and alkaline solutions? Of course not. Some hair reacts violently to baking soda and some hair reacts (swells) very little. Some hair is in between. If your hair is low-porosity, it's probably not extremely reactive - though if your hair is long or the ends tend to be truly dry, they may be more porous than the rest and more reactive. Please, please, please do a test strand first!

If you like the result of a baking soda mixture on your test strand - but it seems too strong, cut the baking soda quantity in half or fourth and try again. *Please note* - baking soda takes a long time to dissolve in room-temperature liquids. If your mixture is gritty, the exposure of your hair to baking soda will be too patchy - more concentrated in some areas than others. Baking soda will dissolve faster in a heated liquid with plenty of stirring. **See more at the end about how baking soda changes your hair.**

In my experience with hair analyses, it is unpredictable whose hair will swell and thus become more porous in acids and bases (alkaline solutions). Some people's hair is very sensitive to vinegar solution, but not citric acid or vice versa. Some people's hair does not swell in baking soda solution, but does in the lather of a strongly alkaline soap bar. If your lower porosity hair is acid *and* alkaline-sensitive and you use an alkaline soap bar followed by a vinegar rinse because the soap is supposed to "open" the cuticles and the vinegar is supposed to "close" them, you have just permanently damaged your hair without meaning to. Maybe a little, maybe a lot. Only time will tell. Your hair is unique. *Only your hair "knows"* whether it will respond badly to being subjected to acidic and alkaline solutions. Do what works for you and observe how your hair responds. If you use a treatment that works well for somebody else and get a undesirable result, don't think there's something wrong with your hair - there's something wrong with how that treatment interacted with your hair.

Lower porosity hair needs different terminology

When we say want to moisturize our lower porosity hair - we're really trying to say something more complicated - but also very simple.

We want it to feel soft. We want it to be flexible. We want it to not tangle excessively. We want our coils, curls and waves to be as well-defined as they can be (or as you like). We want our straight hair to be smooth and reflective, not flyaway. Whereas our porous-haired counterparts can get those benefits with creamy deep conditioners or oils, we just get a limp or greasy or tacky-feeling and unsatisfactory result.

What do we want?!

Lasting *hydration*

Lubrication (slip) and detangling

Flexibility

Weight but not "heavy" and please, oh please no greasiness and no coated-feeling build-up!!!

Softness

Definition (discernible wave and curl pattern, tolerable frizz and flyaway index)

Dose - it's all about dose and application

It's easy to say, "I can't use oils or that conditioner or x, y and z." But sometimes our problem isn't the ingredient, it's the dose. Low porosity hair still needs oils and conditioners, we need them in smaller doses. Or we need those things diluted with water. Or we need to use them before washing our hair instead of after. If you're using a thick, rich conditioner for it's lubrication but it feels too heavy or greasy, look for a lighter-weight conditioner that is more fluid but still has good lubrication.

Low Porosity Hair Hydration How-to (one or more of these may work for you)

1) Work at the surface of the hair with these tips: You can do a lot of hair-hydrating to soften, add flexibility and lubrication with products that never need to do anything but stay on and around your hair shafts, helping prevent water loss and providing superficial effects.

- **Leaving in conditioner:** For low porosity hair, leave-in conditioners are used to add *lubrication, weight and flexibility* and provide *softness*. We are not expecting a leave-in to "soak in" with low porosity hair. We're using it for a superficial effect, as a styling product. If you find that leave-in conditioners seem to sit atop your hair, try this trick:
- The trick for low porosity hair: Use leave-in conditioners on dripping wet hair, *or* apply them and then quickly move your head under and then back out of the shower spray (or pour some water over your hair) for good coverage and dilution. Conditioner for leaving in can be used alone or mixed into a gel like homemade flaxseed gel to combine effects, improve distribution and get it all done in one step. You may not need much leave-in or left-in conditioner and diluting & distributing it with the shower spray or mixed into a styling product can be a necessary step *because you're using it for a superficial effect*. Your leave-in helps style your hair, plain and simple. You can also mix a

little conditioner with distilled water in a spray bottle to apply a leave-in. Not everybody needs a leave-in conditioner. If your hair needs help with flexibility and softness and lubrication, or if your hair is coarse, you're more likely to need some.

- **Film-forming humectants:** [Here is a link to a post about these ingredients.](#) **Film-forming humectants really are the bee's knees for low porosity hair.** Flaxseed gel (linseed) or okra gel (homemade), aloe vera gel, pectin, hydroxyethylcellulose, marshmallow root, slippery elm, panthenol, xanthan gum, Hydroxypropyltrimonium honey, glycine betaine (beet extract, sugar cane extract), seaweed extract or Irish moss extract; all these ingredients form clear, flexible films over your hair that trap water near your hair to keep it *hydrated* or moisturized - but without being heavy, creamy or oily. Protein also falls into this category, more on that below. These ingredients can keep hair hydrated extremely well and also have great styling benefits. Hydrated hair is flexible, well-defined and softer. Look in the "[Product List by Ingredient Category](#)" page to see how these ingredients translate into hair products. The list is near the end of the page. Get your film-forming humectants in rinse-out and leave-on products. The Best Leave On Products For Low Porosity Hair contain a balance of film forming humectants, light conditioning ingredients and oils.
 - **Aloe vera:** What is the deal with aloe and low porosity hair? Does it cause build-up or not. My observation has been that if your hair tends to accumulate build-up in general, it is likely to get some "aloe build-up" which might be a dry, rough feeling. If that's you, you might avoid aloe entirely if you want to keep things simple. But aloe vera *might* still work nicely without unpleasant side effects in a conditioner or included in a cleanser that you use only occasionally.
- **Protein:** Hydrolyzed protein for lower porosity hair acts as a *hydrating* (or moisturizing) agent. Protein slows water loss from hair. Larger proteins form hair-hugging, water-grabbing films over hairs that trap moisture near your hair. Smaller proteins can do this and also settle in under and around the cuticles and keep the water in your hair longer. This is different than oils which just trap water. Proteins grab water from your wet hair and hold on to it so when your hair dries, it stays better hydrated. Moisturized! Fine and medium hair are more tolerant of both large and small protein than coarse hair. Coarse hair that can tolerate protein may do better with smaller proteins like amino acids or hydrolyzed silk, keratin, collagen. Low porosity hair tends to have less of a "WOW!" result from protein overall, but as long as your hair isn't coarse, you might still get some really nice hydration and bounce from protein.
- Fine and medium hair can usually tolerate more frequent protein than very coarse hair. Because protein adds some extra support to hair, it can make coarser hair feel rough and dry and abrasive if used too often. This is a [link to a post with more about protein.](#)
- **Oil choices and oils in products vs. choosing well-balanced products:** Oils for leaving on low porosity hair? Sure! But your hair is probably picky about which oils you use. It will probably vary depending on whether your hairs are narrower or wider and whether your hair is thick (dense) or not.
 - Product base matters with oils and low porosity hair! A product with a film-forming humectant base - a flax seed (gel) base, an aloe vera gel base, Irish moss (aka seaweed extract) base that also includes some oils (but not in the first 3 or 4 ingredients) might be okay for adding oils to or layering with oils...but - see the next bullet point below...
 - Emulsifiers are critical for using oils in low-porosity hair. Conditioning ingredients like Cetrimonium chloride and emulsifiers like Polysorbate (20, 60 or 80) or Cetearth-20, or conditioning emulsifiers like Behentrimonium methosulfate and cetyl alcohol are all emulsifiers. They allow oils to be mixed with water and not separate out. Like the difference between oil-and-vinegar salad dressing and creamy salad dressing. Oils may behave very differently in your hair when they are properly emulsified in a conditioner.
 - If you have a film-forming humectant base with conditioning ingredients and a little oil - you have a well-balanced product like this can be wonderful for keeping low porosity hair hydrated, lubricated and soft.
- **Conditioner chemistry:** Try a conditioner that does not contain cationic conditioning ingredients, or contains cationic conditioning ingredients that are shorter in carbon chain and less likely to build up or feel slimy. Examples are:
- Aubrey Organics (no cationics in Aubrey Conditioners - other Aubrey formulas are fine, but sometimes herbal extracts feel like build-up)
 - Honeysuckle Rose Conditioner
 - GPB Balancing Protein Conditioner
 - Chamomile Luxurious Conditioner
- Curl Keeper Slip
- California Baby Conditioners
- Elucence Moisture Balancing Conditioner
- Earth Science Citress Conditioner
- Giovanni Direct Leave-in (can use as a rinse-out also)
- Giovanni Nutrafix Conditioner
- Giovanni Magnetic Restructuring Conditioner
- Kiehl's Hair Conditioner and Grooming Aid
- Ovation VOlumizing Creme Rinse
- Suave Daily Clarifying Conditioner
- Trader Joe's Refresh Conditioner
- Trader Joe's Tea Tree Tingle Conditioner
- As I Am Naturally Leave-In Conditioner
- Rainbow Research Kid's Conditioners

2) Work at and beneath the surface of your hair with these tips:

- **Oil Pre-Shampoo / Pre-cleansing treatments:** <-- Click this link for a post about how to make oil pre-shampoo treatments work with your hair. With low porosity hair - getting a benefit from oil sometimes means knowing some tricks for using it. Using a hair-penetrating oil on your hair like coconut oil or sunflower oil or olive oil or [my oil blend](#) for several hours before you wash your hair can add *softness*, *lubrication* and *weight* to your hair. Because you wash after this treatment, you won't have greasy feeling hair, but the softness and definition remains. Oils do not create build-up like conditioners can (with the exception of cocoa butter and plain shea butter or other solid-at-room-temperature plant butters). These are ideal treatments for lower porosity hair because even though your hair doesn't soak up loads of oil, it can benefit from it. And because low porosity hair can be build-up prone, oils can be a good option for deep conditioning. When your hair feels tangly, use oils that have good lubrication for your pre-wash such as sunflower, jojoba, olive or avocado.
 - Trick for using oils on low porosity hair: Use a light touch for an oil pre-wash treatment. Enough oil to add some shine, or maybe a little more to add some weight and make your hair feel a little "dirty." *Use this only on the ends if your hair becomes greasy easily.* Leave on for 2-6 hours. Low porosity hair that is not coarse (wide hairs) tends to do better with shorter treatments but slightly coarse and moderately to very coarse hair can take longer treatments. Use a good shampoo to cleanse; if you're using a very mild shampoo, you might want to do a second wash with shampoo diluted with water if you used more oil than you needed. If you're a co-washer, be sure to work the conditioner thoroughly into your hair to remove excess oil.
- **Heat:** 1) Heat (used with hair treatments) may increase your hair's porosity slightly but not in the more aggressive way of acids and alkaline solutions. [See this post for more details.](#) Heat gives your hair a greater surface for binding conditioners. 2) Heat liquefies ingredients, the act of wrapping your hair to apply heat improves product distribution, and *more conditioner will adhere to your hair with heat.* Use heat with deep conditioning treatments if your hair is feeling extra dry or tangling more than usual. Using heat can double the amount of conditioner that binds to your hair.
- **Steam:** Steam combines the beneficial effects of heat (listed above) with an abundance of moisture in the form of water vapor. In the presence of steam and a conditioner, your hair will be plumping up with water and with it will go some of the good things from the conditioner you have put in your hair. Heat increases conditioner binding to your hair, hydrates it to the maximum for even more softening and conditioning. Use a hood or bonnet type steamer or a handheld steamer *made for use on hair.* Steamers made for upholstery or clothing will produce a lot of steam that is much too hot to be safe for your scalp. Steamers for the face are safer for hair also.
 - Steam for deep conditioning treatments *or* steam in your leave-in conditioner or some oil to lock in the steamy goodness instead of rinsing it out.
- **Deep conditioning:** Lower porosity hair does not pick up as much conditioning as hair that is more porous. If your hair needs an intense burst of softness, detangling or hydration, use a deep conditioner, or your usual conditioner with a little oil and whatever else you like added.
- - Add heat or steam to the treatment, barely warmer than body temperature is all that is necessary.
- - Leave it on 5 minutes for hair that is easily over-conditioned or gets too soft, 10-30 minutes for the most intense effect.
- See [this post for more details](#) about how to work with heat and timing for deep conditioning.
- **Alkaline solutions:** But promise to do a test strand first and pay close attention to how your hair responds. Baking soda mixed with conditioner or water at whatever concentration works for *you.* These can temporarily (and permanently) alter your hair's porosity and may change surface texture. But there's more to baking soda than porosity...
 - *The probable explanation for the positive result some people get with baking soda mixtures is related to [surface chemistry as well as porosity.](#)* The alkaline baking soda solution likely disrupts or breaks down the "F layer" containing 18-MEA (the lipid-rich epicuticle - see the beginning of [this post](#)). Once this has happened, the hair is no longer as hydrophobic (water-repelling). **Hair becomes more hydrophilic (water-attracting).** It becomes wet more easily. There is a disrupted lipid barrier (the epicuticle is degraded or removed) that was slowing the movement of water in and out. *As a result, the hair will bond with more of whichever cationic conditioner you apply.* At least the first time you use conditioner after the alkaline treatment. This still isn't porosity, it's surface chemistry. **You lose the natural lipid layer and replace it with commercial conditioner.** Conditioners have different textural and aesthetic qualities from the oils that were on your hair before.
 - Alkaline baking soda solutions and soap bar lather cause hair to swell. Anything you want to get into your hair shaft needs to be in this solution or applied immediately after. Once you rinse, your hair begins to return to its non-swollen state.
 - Some people report a similar effect with bleached or highlighted hair - that it holds a curl better as a result of the treatment - and for very similar reasons. Sometimes alkaline solutions give hair a slippery feeling - alkaline solutions tend to feel slippery in general - they're dissolving the oils on your hair and skin, *sort of* turning them into soap. It's a similar chemical process. After repeated use, alkaline solutions may leave your hair more porous overall because there is exchange of solutes in the hair for alkaline solution while the alkaline solution is on your hair. Proceed with caution when using acids and alkaline ingredients on your hair and scalp. If you notice a problem, please consider taking a break from these ingredients, or try one of the next tips to buffer the effects of baking soda...
 - Mix your baking soda with yogurt (unflavored, unsweetened) to take advantage of yogurt's hydrating qualities, some of the smaller proteins and amino acids and lactic acid (and other acids) and unique lipids from the milk. Yogurt bring the pH down to closer to 7, but still causes some swelling of the hair. Rinse really well to avoid stinky yogurt-hair later on!
 - Mix your baking soda with conditioner to buffer the hair a little - this does protect the hair a little.
 - Use shampoo bars or superfatted bar soap instead of liquid castile soap - the oils help protect your hair by adding lubrication.
 - If you use liquid castile soap, dilute it with water and add a little oil for lubrication.

Flexibility:

Flexibility is something that is inherent in your hair, in its curl pattern, and in its hydration level. Some people's hair is less flexible because it's internal structure is somewhat more rigid. Examples are very coarse (wide) hair, curly, coily or highly-textured hair, or some gray (white) hairs. It's not the

amount of curl that matters as much as the tendency of that hair to conform to whatever shape you try to apply - or to go along with its neighboring hairs. The type and arrangement of proteins in your hair has a lot to do with its flexibility and curl pattern. Some of us have area of different curl patterns that are more "naturally inflexible" or else we have those hairs scattered over our heads. These hairs tend to be or at least to behave as low porosity too.

- To help your lower-porosity hair be more flexible, keep the water levels optimal. That means using film-forming humectants, preventing water loss with balanced products which contain film-formers (i.e. plant-based gels), a little oil and/or some conditioning ingredients.
- Meanwhile, give your hair some daily help (or whenever it feels less-flexible) with a hydration spray such as a mixture of distilled water and conditioner and anything else your hair appreciates that might improve hydration like aloe vera juice or a protein additive like Neutral Protein Filer. Use this spray lightly to bring moisture and flexibility to your hair and get the water levels back up. Unless the air around you indoors and outdoors is humid all day (tropical or nearly so), your hair will tend to lose moisture to the air.
- For added flexibility, when hair looks dull or begins to spread out and lose definition, feels inflexible or sounds crunchy, use a little oil (spread a couple drops on your palms and fingers and rub until they shine) on the ends and work your way up. Oil can be used alone for flexibility and definition, or it can go *under or over* a hydrating spray.
- Conditioner pomade. Rub a little conditioner between your palms and fingers until it's a bit dry and pasty feeling. Use that on any frizzy or inflexible areas - smooth it over sections as though making a ponytail(s), or as though you are pinching and sliding a ribbon between your fingers for smaller sections. The ingredients in conditioners have a very light "hold" and tack unlike oils. This can be done on damp or dry hair.

Other hydration boosters:

Aloe vera rinse: Combine 1 part aloe vera juice (the drinkable kind) with 1 part water. Add a small squirt of glycerin if you like. Apply with a cup or squeeze bottle, work through and leave on for a minute or two. Rinse. The reason to dilute with water is to keep the pH around 5 because aloe vera juices can be quite acidic which is harsh hair and may irritate your scalp and eyes.

Honey: Mix warmed honey (do not let it boil, it will become hard when cool) into conditioner or with warm water or warm herbal tea. Apply to hair as usual for conditioner, leave a honey rinse on for a few minutes. You can use this with heat too.

Banana: You must be careful with bananas! Banana has amazing hydrating and shine-enhancing power. No green bananas. No solid-yellow bananas. I am not kidding. It's really hard to wash out banana chunks and for some reason, when you put banana in your hair which has not been pureed to complete and total mush or is not ripe enough - it forms chunks. In your hair. But when it is good - it is so good! Honey and banana combination can soften hair a lot. Blend up 1/4 to 1/2 very ripe banana (lots of brown spots on the skin) and apply it to your hair - with some warmed honey if you like. Leave on with heat for 3-5 minutes. A better idea is to use baby food banana puree if you have never used banana before.

Yogurt: Stick with non-fat plain (unflavored, unsweetened) yogurt if your hair is easily weighed down. The lactic acid in yogurt hydrates hair and there are some proteins that are small enough to be "active" in your hair. Use this before a thorough cleansing to avoid any lingering yogurt in your hair or else rinse really, really well. In my experience, yogurt can make hair feel like it has a lot of "drag" in it and needs a lot of slippery conditioner to un-do that effect.

Avoid dehydration:

Your low porosity hair is what everybody else is trying to mimic with deep conditioners and hair repair agents. Don't dry it out! Wear a hat or scarf in the sun and in cold, dry air. If you get a lot of sun exposure, use some protein if your hair tolerates it. Sun will make hair more porous, though not necessarily more rough. People with thin hair (not dense) or with haircuts that leave hair not dense (lots of layers) people with white hair and blonde hair will have more UV damage than dark brown to black hair.

Avoid high-heat styling tools.

Protect your hair while swimming, and when out in the wind.

Use lower peroxide hair color or plant dyes to color hair - or get your hair as healthy as possible to let your natural color be it's most intense.

Wear a silk or silky, smooth scarf, bonnet or "buff" at night to reduce friction and create a little humid environment around your hair - the humidity comes from your skin.

Every day give your hair some hydration. If you aren't wetting your hair daily, mix up a spray bottle with distilled water, a small amount of conditioner, and other goodies like aloe vera juice or a hydrolyzed protein additive or boil the distilled water with marshmallow root or horsetail or nettles. Mist your hair with this to provide water, lubrication and ingredients with lasting hydration to keep your hair supple all day.

Or use a steamer (if you have one) to provide moisture during dry or windy weather.

Oils can soften and lubricate hair in between washes if it gets that rough or stiff or lighter colored look on the ends.

Hard Water: (added May 2016)

If you have hard water in your shower, it will make the behavior of your low porosity hair more pronounced. [See this post for more details and how to manage hard water and your hair.](#) If you have "city water" - treated and distributed by a municipal water treatment facility, you can contact them or check their online report or the one they mail you annually for hardness. Minerals in hard water bond to hair just like conditioner does. To put it another way - *the minerals in your hard water compete with the cationic conditioners in your conditioner for binding sites on the surface of your hair.* So there are the hair-lubricating and softening cationic conditioners fighting it out with the hair-stiffening and friction-creating calcium and (to a lesser degree) magnesium in your water. Hard water makes your low-porosity hair even less friendly towards oils and conditioners.

[Follow my blog with Bloglovin](#) Reduction-Induces Surface Modification of Human Hair. Kamath and Ruetsch. Journal of Cosmetics Science, 2010. 61, 1-12

Posted by [WS](#) at [2:18 PM](#) [261 comments:](#)

Labels: [Low porosity hair](#)

Tuesday, July 23, 2013

Hair Swelling in Water

This subject came up recently on the Wavy Hair Community and I wanted to do a little research to find out how much water is too much - and for how long.

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Hair does not take on water immediately, it is designed to repel water in its unaltered state. Whenever I put hairs in water to photograph them, they do not swell dramatically to the point at which the cuticles are standing up and things look awful. The measurements you'll read about below are tiny. Your hair is probably more protected than the hair cited below by things like conditioner, hair gel and maybe oils - including those that protect your hair naturally. There are 2 ways to get hair to swell with water - expose it to high relative humidity and soak it in water.

When hair begins to swell with water, the swelling is initially distributed along the length of the hair and hair can actually increase in length (temporarily) as a result. But not very much. Think of the pressure exerted on a garden hose when the end is open and water is flowing freely.

When hair is maximally swollen, the pressure of the water strains against the perimeter of the hair shaft. Imagine garden hose in which the "open" end has been plugged. Swelling creates an increase in diameter.

Hair takes on water in high humidity, this causes swelling. At 40% relative humidity, hair can increase in diameter by 5%. At 60% relative humidity swelling can be 7%. When the relative humidity is 100%, hair can increase in diameter by almost 14% because it has taken on water from the air around it.

Things which dramatically increase swelling of hair (much more than water alone): sodium lauryl sulfate, thioglycolic acid (perms), other detergents when concentrated, high pH solutions. Glycerin actually causes less swelling than water!

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Swollen hair has several problems. One is that swelling increases pressure and pressure tends to strain tissues. Strain after strain weakens hair over time. Swollen hair's increased girth means that the cuticles stand out - as though you glued tiny shingles on a balloon and then blew it up. That allows water into areas which should be protected by the cuticle. Swollen hair gains weight as well as girth. This causes it to either express its curliest version of itself if the curl is strong (then the curls lose definition to poufy frizz), or go limp when curls are present but not strong relative to the weight of the fiber+water.

Swelling and loss of proteins:

The area just beneath the hair's protective cuticle layers or "endocuticle" of hair may be the area most prone to swelling. It is also loaded with water-soluble, polar -therefore water-attracting- amino acids. It is covered by the membrane-like exocuticle and the sebum from your scalp, both of which provide water and chemical resistance, but both of which are also subject to chemical and physical degradation. In other words, when you get your hair wet, you lose amino acids (protein) from your hair.

How long is too long?

One study published in the Journal of the American Academy of Dermatology tested caucasian hair, African hair and Asian hair swelling when soaking in water vs. time. By about 150 seconds all hair had reached its maximum swelling. That's less than 2.5 minutes in water! Note: The authors did not mention whether the hair had been washed prior to testing, or had any other treatments. I think it's safe to assume it was washed first.

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Heat, water and oils:

Water alone does not remove oils. Water and oil do not mix! But oils are not all the same. Oils from your scalp, oils you apply to your hair (including conditioners) can be more-or-less solid at room temperature. Many oils from your scalp and in conditioners have high melting points - coconut oil is an example. Heat can melt certain oils. If they can be melted, they are more likely to be removed with any sort of detergent (even cationic ones) and they are more likely to be carried away with water if possible. Especially if combined with a long soak in which some of the oils might find their way free of the hair. This is why warm to hot water cleans greasy stains better from laundry.

What can you do to reduce water-damage?

- Use emollients like coconut oil or other [hair-penetrating oils](#) to help make your hair more water-repelling to slow the movement of water into the hair. Conditioners may also be helpful. [Here is a post](#) with pictures of hair protected by various oils and conditioners in chlorinated (and high pH) water).
- Use not-hot (lukewarm or cool) water for washing your hair. Your skin likes that better too.
- Keep the amount of time your hair is in the water to a minimum. By the time you've been in the water for 2 minutes, your hair has swollen as much as it can. *But I think you have a little more time than that, thanks to hair gel, and conditioners which form a film on the surface of your hair.*
- Wash your hair as infrequently as you can stand. The oils from your scalp are well-suited to keeping your hair healthy and hair is designed to repel water by itself if it is not damaged or over-handled.
- Reconsider bleaching and highlighting and other chemical processes. These treatments make hair more porous - so it takes on water sooner. These treatments also erode the epicuticle, leaving your hair with less natural protection. If you do these to your hair, take extra steps to avoid getting waterlogged.

I don't know about you - I may have to start leaving my hair dry until the end of the shower. And I take fairly quick showers!

2003 Current research on ethnic hair

Journal of the American Academy of Dermatology, 48 No. 6

A. Franbourg, P. Hallegot, F. Baltenneck, C. Toutain, and F. Leroy

Chemical and Physical Behavior of Human Hair

Robbins, 1994. 3rd Ed. Springer-Verlag, New York



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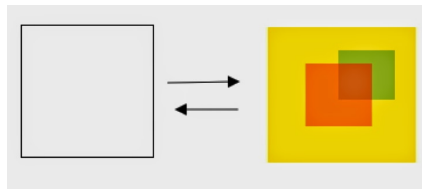
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Saturday, February 7, 2015

Why Does White (or gray, light blonde, highlighted) Hair Turn Yellow: And what to do about it

This applies to white or gray, highlighted and blonde or light brown hair that may tend to become brassy or develop an unnatural color tint - yellow, red, orange or greenish.

White hair has no pigment. Although sometimes that's not entirely the case as a hair turns white. And sometimes there's a dark medulla to add color. The lighter your hair overall, the more likely discoloration from any source will show.



What causes yellowing of light-colored hair?

- **Water chemistry:** Hardness or natural minerals, chemicals used for water treatment, seasonal water chemistry changes all impact whether or not your water discolors your hair. For example, if your water source comes from lakes and rivers, it varies greatly (within drinkable limits) with changing seasons and the treatment needed to make the water safe to drink. Some water is high in iron which can give hair an orange, red or yellow cast. Other things in water (metals) can cause green or brown discoloration. Alkaline water can be also problematic (hard water that feels slippery). It's not just minerals that vary, it's nitrates and nitrites, the amount of chlorination required, use of chlorine vs. chloramines for disinfection and whatever your water picks up from pipes on the way to you.
- **Hair products.** Some oils and emollients, preservatives, and colorings can leave a yellowish cast on hair.
- **Scalp oils.** Sometimes your own sebum can give your hair a yellowish cast. And your own sebum can vary with seasons - sweat, heat or cold, activity level, microbial activity on your scalp. Natural sebum is a good thing. Don't worry about this one. But if you have oily scalp and you are not forcing it to produce lots of oil by over-washing it, wash it regularly - just don't dry it out. If you wear a hat often - wash the hat regularly or put in a hat band or liner that you can remove and wash. Also remember to wash your comb or brush - any tool that is in contact with your hair every 2-3 weeks in water with some diluted shampoo or hand cleanser to remove any "old" oils that might deposit on your hair.
- **Smoke, pollution.** Your hair can pick up these things. Especially close-up smoke like that from smoking cigarettes.
- **Swimming pools and ocean water.** Minerals in pool fungicides can cause a greenish or yellow tint, chlorine can increase hair porosity. Salt water dehydrates hair and causes porosity-increasing friction.
- **Sunlight:** UV light tends to make hair become more porous and it may also induce yellowing in some hair.
- **Chemical processes:** Perms, relaxing can make hair more porous so it is more easily discolored.
- **High-heat styling.** Heat from hair dryers on the "high" setting or much higher heat from curling irons or straightening irons tends to make hair more porous so it is more easily discolored.

What to do?

1) **Purple shampoos or conditioners (or additives)** - usually made for grey, blonde or silver hair. Purple is meant to cancel out the yellow shade - to deposit a tiny bit of purple to trick your eyes into not seeing the yellow. A purple additive such as "**Ardell Red-Gold Corrector**" is a commercial product which can be added to shampoo, hair gel or leave-in conditioner so that it is a light shade of purple if you prefer not to use an unfamiliar product.

- Kevin Murphy Blonde Angel Wash
- Overtone Color Conditioners (purple and lavender shades)
- Clairol Shimmer Lights Shampoo
- One N Only Ultra Shiny Silver Shampoo
- Fudge Clean Blonde Toning Shampoo (and conditioner)

2) **Bluing.** Mix a few drops of liquid laundry bluing into shampoo or conditioner for a fairly vibrant blue - or just a little into a leave-in conditioner or hair gel so it is "sky blue." This color of blue is very effective at canceling out yellow shades in white hair and also in toning down brassiness. It especially enhances cool shades of brunette and dark brown hair and can give blonde and light brown hair an ash (cool) tone. If purple doesn't help - blue (bluing) may work better.

1 and 2: a) Use **food coloring** instead. You can use a few drops of blue food coloring in shampoo or conditioner, or blue + red to create purple. If this mixture, or a purple shampoo *almost* works, but you still have some reddish shade appearing, add the same number of drops of green food coloring

to the mixture (example: 1-2 drops each of blue, red, and green). Have a mirror handy. If you over-did the color additives, wash your hair a second time.

3) If minerals or metals (copper, iron for example) in water are discoloring your hair, try a **distilled water wash**. Warm some distilled water and use it for your entire wash and rinse. This can help diagnose whether water chemistry is a problem for your hair. If you notice a benefit from doing this, you might try combining it with one of the suggestions from #4 or #5 below to remove minerals from the hair, or with a purple shampoo or a bluing-added product from #1 or #2.

4) **Hard water shampoos and treatments** (commercial). **Ion Hard Water shampoo, Ion Crystal Clarifying Treatment, Malibu Wellness Hard Water Weekly Demineralizer or Malibu Wellness C Blondes Weekly Brightener**. These treatments can remove hard water minerals (calcium, magnesium) and other problem minerals from your hair. *But if you have more white hairs than colored hairs or you have very light blonde hair or light highlights, you must do a test section first to be sure you will not get discoloration from the treatment.* These treatments combine mineral chelators such as EDTA or citric acid with mineral dissolvers and detergents to remove product build-up. Hard water can exacerbate product build-up.

5) **Lemon juice treatment** (Do It Yourself). This is shampoo-free. It may help remove mineral deposits and it may brighten blonde and light brown shades. Mix equal parts lemon juice (strain out any pieces of pulp) and distilled water. Apply this to your hair (put it in a squeeze-top bottle for easier application). Work it in well and cover your hair with a shower cap, treatment cap or wrap your hair in plastic. Leave this in your hair with some heat for 3-5 minutes, then rinse well and follow with cleanser/shampoo and conditioner.

The pH of this treatment is very low, so you may want to do a test-strand first to assure it is not too drying for your hair. The combination of citric and ascorbic acids help dissolve and trap (chelate) minerals and remove them from your hair.

You can make mock lemon juice with 1.5% *each* citric acid and ascorbic acid in distilled water. This will also have a very low pH and need to be used on a test-strand to make sure it does not dry your hair.

6) If you notice yellowing after adding a new product, the product may be the problem. Discontinue use of the product for a while. If it is more than one product causing the problem, scan the ingredients of the offending products for ingredients they have in common. Those ingredients may be potential offenders. Oils, some preservatives, herbal ingredients and colorings can discolor hair, for example.

7) If you began using oils in your hair, or if you have been sweating more than usual - you may need to shampoo your hair more thoroughly. You may find that some plant oils cause yellowing and others don't. Or some parts of your hair may be more inclined to yellow than others.

8) Treat any scalp disease you may have (seborrheic dermatitis, for example) so the oils on your scalp have the right composition and are not over-produced. You may want to avoid tar shampoos (unless that is the only thing that works) because they can cause discoloration.

9) Manage porosity in your hair by using conditioners, protein as your hair tolerates it, handle your hair gently (don't brush vigorously, don't rub and scrub it with a towel - just blot and squeeze dry), use oil pre-wash treatments to prevent "waterlogging." See [this post](#) for more about managing porosity.

10) Wear a hat, scarf of "UV buff" in the sun or use a UV protectant in hair products such as Cinnamidopropyltrimonium chloride, Quaternium-95 and Propanediol (they need to be together), Polysilicone-15 or Benzophone-4.

- **Cinnamidopropyltrimonium chloride** has been demonstrated in lab tests to prevent yellowing and increased brittleness in white hairs exposed to UV light (Gao and Bedell, Journal of Cosmetic Science, 2011. Volume 52, p.103-118)

11) **For swimmers**, use one of the mineral-removing treatments from #4 and #6 occasionally. If your pool allows, apply a little coconut oil or conditioner to your dry hair and wear a swim cap. The oil or conditioner protects the hair from pool water and the swim cap doesn't allow new water to constantly flow past and through your hair.

12) Other commercial products:

- **Manic Panic "Virgin Snow"** is a conditioning "white hair toner" (it's purple in the bottle) with no peroxide that is left on the hair for 15-30 minutes to correct discoloration.
- L'Oreal Colorist Secrets "Brass Banisher" is a product that does contain peroxide for removing unwanted brassiness (red and yellow colors). If all else fails...

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