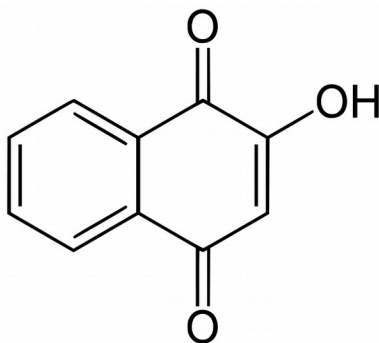


Dye release: When Will the Henna Paste be Ready?

Fortunately, henna is very forgiving, and it's nearly impossible to do something wrong that you can't fix later. The following is a very precise description of henna dye release, because it's important to know what the science is before you relax and bend the rules.



Lawsone is the dominant dye molecule produced by henna; there is a precursor and an intermediate form of this molecule. Only the intermediate form readily stains hair.

If you hold henna leaves in your hand, your hand will not be stained. You have to break down the henna leaves in one way or another to release the dye molecule, lawsone.¹ First, the henna leaves have to be crushed. Ancient Sunrise® makes sure their suppliers crush and sift henna leaves to a high standard, higher than other henna hair dye suppliers. After the henna leaves are crushed and sifted, the precursor lawsone molecule is more available. This powder has to be mixed with a liquid to change the precursor form of lawsone to the intermediate aglycone lawsone molecule. If the mix is acidic, the hydrogens will stay attached to the corners of the aglycone and will be ready to bind to the keratin in your hair.² That's the optimal time to put henna into your hair. If lawsone aren't in contact with keratin during this optimal time, they'll bind with the free oxygen in the paste or in the air, and stain hair weakly or not at all.

An HPLC test of powdered henna leaves generally shows 0.5% to 3% lawsone, a red-orange naphthaquinone molecule³ which readily, harmlessly, binds with and stains keratin. This staining action is facilitated when the powdered henna leaf material is mixed with a mildly acidic medium; a pH 5.5 paste mix is ideal. At this mildly acidic pH, the lawsone molecule can be released from its position on the tannin and migrate from henna paste to stain keratin.⁴ A

¹ There are some folkloric traditions comparing henna to a woman, in that both become more beautiful after they've been through hardship.

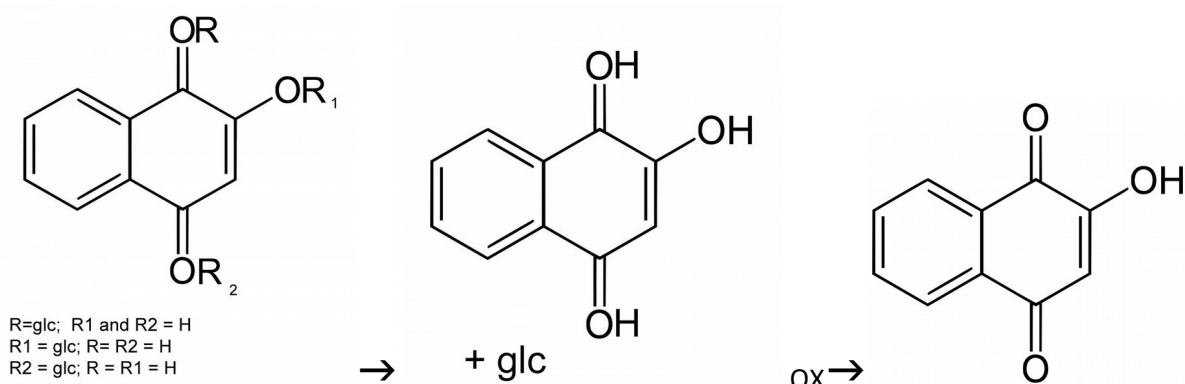
² Compare this to tea stains on a white tablecloth. A dry tea bag on a tablecloth won't leave a stain. A wet teabag will stain a tablecloth: the molecules migrated from the teabag through the liquid into the tablecloth.

³ HPLC laboratory results, Alkemist Laboratories for TapDancing Lizard LLC, 2008 - 2016

⁴ Amro, I. H., James, K. C, and Turner, T. D.; 1993. "A Quantitative Study of Dyeing with Lawsone," *Journal of the Society of Cosmetic Chemistry*, **45**, 159 - 165

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Michael Addition facilitates a non-fading stable bond of the lawsone molecule with keratin. This red-orange stain can gradually oxidize to a brownish color when bound with keratin. In alkaline conditions, the stain can oxidize to black or greenish black.



The sequence of henna dye release and binding is as follows:⁵

Lawsone is produced by hennocide precursors in the henna leaf.

The precursor is converted into the intermediate aglycone by hydrolysis in mildly acidic conditions. The aglycone intermediates will bind to keratin. Neither the precursor nor the final lawsone will bind as effectively to keratin as the aglycone intermediate.⁶ In the mildly acidic henna paste at room temperature, the aglycone will become available after about an 8 hour soak, and remain at maximum in the paste for 12 – 24 hour hours, after which the percentage of the bindable aglycone form of the lawsone molecule will gradually diminish. This is termed ‘demise’ of the henna paste. At this point the henna paste produces diminishing stains. This transformation is gradual at room temperature. It proceeds more quickly in warm conditions and slows under cold conditions. Eventually all of the unstable aglycones will transform to the stable non-bindable form of keratin. This usually happens in about one week at room temperature; in henna work, this is referred to as demise. This demised henna paste stains keratin a weak orange color which will not darken because it can no longer bind through Michael Addition.

The acidic paste maintains the hydrogen atoms on the corners of the aglycone, the intermediate form of the lawsone molecule. In acidic mixes of henna, the intermediate form of lawsone will migrate into the keratin in hair or skin, and darken as it binds permanently with the keratin by a Michael Addition.⁷ If the henna powder is mixed only with water, the hydrogen atoms are not as

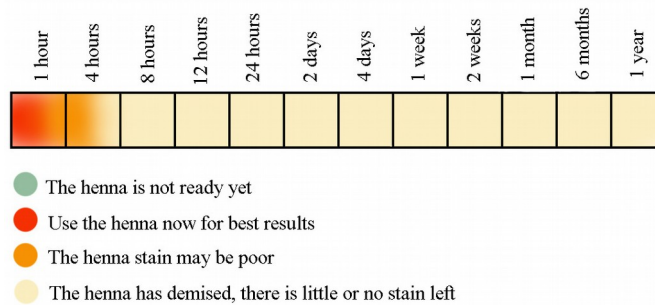
⁵ Gallo, F., Multari, G., Palazzino, G., Pagliuca, G., Zadeh, S. M. M., Biapa, P. C. N., Nicoletti, M.; 2014. “Henna through the Centuries: A quick HPTLC analysis proposal to check identity.” *Revista Brasileira de Farma Cognisia*. 24, 2

⁶ Attempting to improve henna powder by adding lawsone powder will not improve the henna stain. Only the intermediate aglycone can effectively stain the hair.

⁷ Ruchi Badoni Semwala, Deepak Kumar Semwala, Sandra Combrinck, Catherine Cartwright-Jones, Alvaro Viljoen "Lawsonia inermis L. (henna): Ethnobotanical, phytochemical and pharmacological aspects." *Journal of* "Ancient Sunrise® Henna for Hair," Chapter 7, Mixing and Testing Your Henna Mix, Copyright © 2015, Catherine Cartwright-Jones PhD, TapDancing Lizard® LLC www.mehandi.com www.hennaforhair.com www.ancientsunrise.com

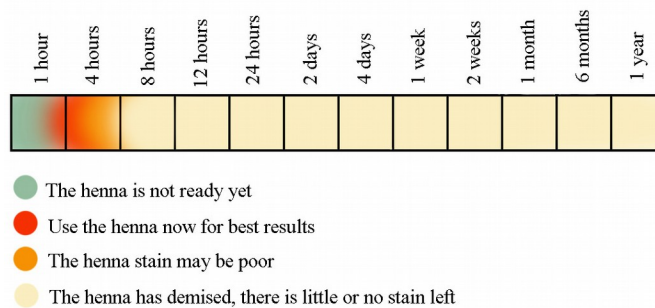
well conserved. Henna mixed with water is more likely to fade from air because unbound lawsone will gradually wash out of hair. Henna mixed with a mildly acidic mix will leave a stain in hair that is not only permanent, but will gradually darken, and continue to darken for years.

Adding heat to the process of dye release makes release go faster. Cooling the process makes it go slower. I prefer the slower, cooler dye release sequences because you get better long term results. The cooler mixes are more forgiving, give more natural-looking results, and you have a longer window of opportunity for using the paste. Here is a series of time tables for mixing and using. All of these times are approximate. The enzymes in fresh fruit juice tend to make the process move faster. Purified citric or acetic acid makes the process move slower.



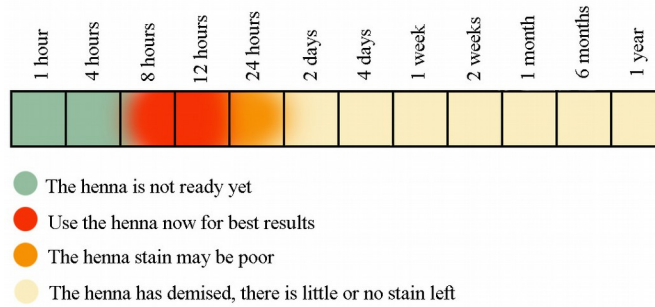
Henna and boiling liquid

If you add near boiling liquid to henna powder, the paste will be ready immediately. Do not delay using a hot paste, because the lawsone oxidize and demise very quickly. Hot paste results tend to look brassy and fade over time. A hot paste mix is a good stop gap if you have a henna emergency, throw out any leftovers.



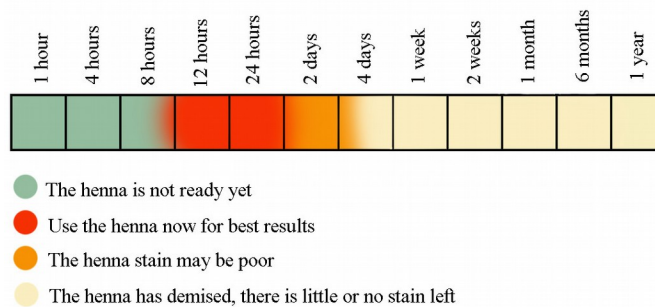
Henna in a hot place, 100F to 140F or 37 to 60 C

If you're in a hurry and don't want your henna to go brassy, put your henna mix in the car, in the sun, with the windows rolled up, or some other place that's 100F to 140F, 37 to 60 C. Check your paste in one hour for dye release. Do not put your henna paste in the oven or microwave; ovens heat the paste unevenly.



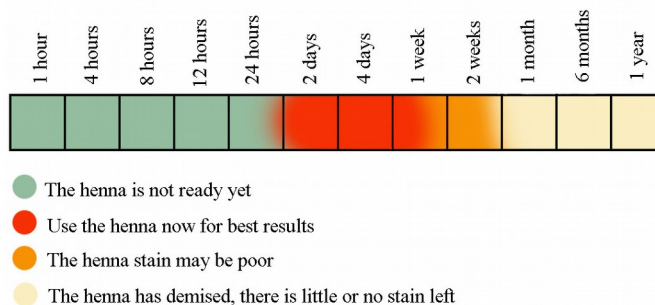
Henna on a warm day, 80F or 26 C

If you have a warm room or on a warm day, 80F or 26 C, mix your henna in the morning and it will be ready in the afternoon or evening. If you can't use it twelve hours after you mixed it, cover the paste and put it in your refrigerator or freezer, to save it for later.



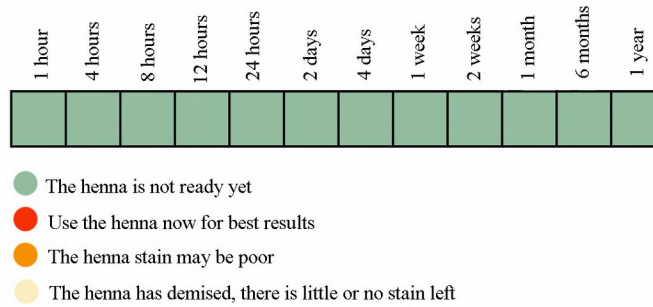
Henna on a cool day, 65F or 18C

If it is a temperate, mild day or in a cool indoor setting, 65F or 18C, mix your henna the night or day before you intend to use it. If you haven't had a chance to use your henna by the second day, put it in the refrigerator or freezer and save it for later.



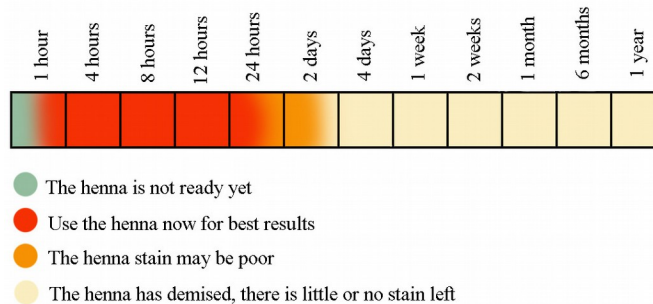
Henna in a cold place, 40F or 4 C

If you aren't sure when you can use your henna, mix it and put it in the refrigerator at 40F or 4 C. It will be ready in about two days, or you can leave it there for a week, and your paste will be ready and waiting for you.



Henna in the freezer, 25F or -4C

If you mix henna and immediately put it in the freezer, it will remain on the verge of dye release indefinitely. When you are ready to use your frozen henna paste, just thaw it and use it or keep it in the refrigerator. Frozen and thawed henna kept in the refrigerator will be ready to use for several days. If you are mixing henna for a salon or customers, I recommend that you mix large amounts of henna paste when you have some spare time, then freeze it to be thawed when you need it. Thawing small packets of henna as needed eliminates wasted henna and wasted time. Re-frozen and re-thawed henna has reduced dye content.



Henna in the freezer, mixed and allowed to release dye prior to freezing, then thawed

If you allow your henna to release dye before you freeze your henna paste, your henna will be ready to use as soon as it thaws. Freeze it in small packets, ziplock bags, carrot bags, or ice cube trays. If you freeze your henna in these small packets, you can quickly touch up gray if you don't have time to henna all your hair. Many people report that frozen henna gives an especially robust color, probably because the freeze-thaw process assists the breakdown of cellulose and henna leaf cells.⁸ You can either freeze the paste without dye release, or you can do dye release, then freeze. Mix a kilo of henna at a time in a large bowl. It's cumbersome to mix more than one kilo at a time. If you anticipate using five kilos of henna over many months or clients, use several bowls. When you have a large amount henna paste mixed to your favorite consistency, spoon it into a small food chopper and whirl smooth.

⁸ In gardens, henna leaves become limp and dead if temperatures fall below freezing.

Need Your Henna in a Hurry?

If you don't have a warm place to dye release your henna, and you need it soon, try one of these to gently warm your henna:

- Cover your bowl of mixed henna with plastic wrap. Wrap that bowl of henna in a towel, and place a heating pad or electric blanket over or around it. Check your henna every 20 minutes to see if there appears to be dye release.
- Cover your bowl of mixed henna with plastic wrap. Put the bowl of henna in your car, parked in the sunshine. Roll up the windows. Check your henna for dye release every 20 minutes on a cool day, and every 10 minutes on a hot, sunny day. Parked cars can get very hot very quickly!
- Don't try to heat your henna in a double boiler. That's a big mess.
- Don't try to heat your henna in the oven; the heating will be uneven. Also, someone may come along and decide to preheat the oven for dinner without checking what's inside.

If you didn't mix up enough henna and find that you need some emergency henna to finish the job, heat up some water and lemon juice and mix a little more henna with a hot mix, and use it immediately. It will nearly blend with the rest of your henna, and won't do any harm.

What Does Henna Dye Release Look Like?

If you think your henna paste is ready, and you've made a reasonable guess from those time tables, the paste is probably ready. Keep your henna or cassia paste covered while it rests, so it won't get dry and crusty. The crust is difficult to stir back in.



Henna may be slightly browner when it has released dye, but this is not always the case

The surface of your henna may be slightly browned when there has been dye release. Is the henna below the surface a different color from the top? Dig into the henna with a spoon and see if the middle of the henna is a different green from the part that's been in contact with the air.⁹ If the surface is darkened, lawsone molecules have been released and have oxidized where they were in contact with air. Sometimes there will be little pools or drops of brown liquid oxidized lawsone. Cassia doesn't turn brown like henna, but the dye release times are similar. Not all henna has a visible color change at dye release; if you don't see a color change and you think the henna has set long enough, it has probably released dye.¹⁰

⁹ Thin plastic wrap doesn't completely prevent air from reaching the surface of the henna. You may see a brown liquid in little puddles or in the folds of the plastic. That is lawsone and tannins, oxidized and released from the henna.

¹⁰ To view the complete application processes for cassia, see chapter 8, Examples 1 and 2. To view the complete application process for henna, see chapter 8, Example 3.

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Stir the paste; it will become smooth and creamy. The texture should be about like toothpaste or pancake batter. Adjust the texture of the paste with more acidic liquid if it seems too thick. The paste should slowly flow off the spoon. The paste is now ready to apply to hair, unless you're mixing in indigo.



If you want to save time and money, or if you are a stylist, mix a lot of henna or cassia at once, spoon the extra henna in bags or ice cube trays and freeze it. Then, you'll have henna ready any time you need it. Frozen henna or cassia paste will keep for months in the coldest part of your freezer. If you are a stylist, and have a freezer full of henna and cassia cubes, you'll be ready for any client within minutes! Just thaw, mix, and apply.



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