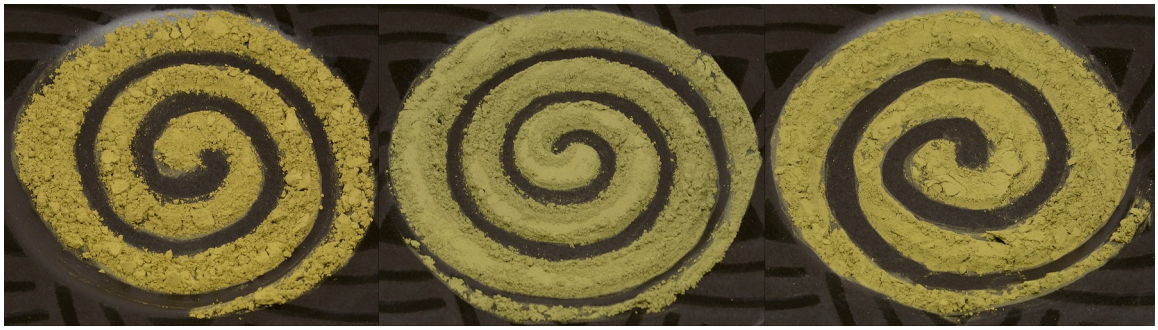
Three Plants Dye Hair: Henna, Indigo, and Cassia



Powdered cassia, henna, and indigo leaves

Few plants can be used to dye hair conveniently and safely. Henna, indigo and cassia powders are green powders, similar in appearance, because they are all dried powdered leaves, and all contain dye molecules that can safely and effectively dye hair. The green chlorophyll in the leaves hides the dye molecules. Cassia contains a yellow dye molecule. Henna contains a red-orange dye molecule. A dark blue dye molecule can be derived from indigo. These dye molecules will stain keratin, the structural protein of hair.

Cassia, henna, and indigo stains on light-colored human hair

The shape of a hair keratin molecule has sites for dye molecule binding, and these sites have specific shapes and conditions for binding. Henna has lawsone, a napthoquinone molecule, which binds very efficiently with keratin in its intermediate aglycone state. Cassia has chrysophanic acid, an anthraquinone, which also bond with keratin in the intermediate aglycone state, but not as efficiently as henna. Fermented indigo has a molecule, indigene, which can be broken down to an intermediate indoxyl that will bind to keratin. Each of these intermediate molecules are unstable and will only dye hair efficiently during the brief period of time they are in the intermediate state.

One way or another, the pigment in the powdered cassia, henna, or indigo leaves has to migrate from the leaf to the hair, and then bind with the keratin in hair, rather like 'tetriminos' that you coax into place during a game of Tetris, or like a wet tea bag staining a white tablecloth.

Only a few pigments will bind with hair and dye it permanently. Beet juice won't dye hair red; it will wash out. Blueberries won't dye hair blue. Beet juice and blueberries will color ice cream, but their dye molecules aren't the right shape for 'keratin tetris.' Madder can temporarily stain hair rich red, but fades after a few washings. Wool and silk dyers often use heat and mordants to make differently shaped molecules attach to hair. Heat expands the keratin molecules, so it's

easier to jam in a molecule that doesn't quite fit. Mordants 'rough up' a molecule so it's easier to jam in a dye molecule that doesn't really fit.[1]

When these cassia, henna, and indigo molecules bind with keratin, they dye hair.[2]

Different fruit juices mixed with cassia will change the stain results. Cassia is translucent and the results will be different on different colors of hair. Cassia will not make hair a paler color.

Different fruit juices mixed with henna can change the stain results. Henna is translucent and the results will be different on different colors of hair.

You can achieve a broad range of colors by mixing cassia, henna, and indigo, and using different fruit juices in the mix.

You can dye hair 'black cat black' by dyeing it first with henna, then dyeing over that with indigo.

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[1] Since it is imprudent to boil your head or soak it in a caustic solution, we're limited to the few molecules that bind easily to keratin.

[2] Painting hair is different from dyeing hair. Paint adheres to a surface (like a tee shirt with a rock band logo). A dye penetrates the surface and stains it (like a tie dye tee shirt).

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