

HAIR DYES

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hair dye are used for hair coloring are of relatively ancient origin. The earliest known hair dyes were natural organic substances obtained from plants which were used as infusions, decoctions, or packs. From ancient times henna was used for coloring hair.

Hair dye preparations are products that either reduce the colour of hair such as hair bleaches, or products that add colour to attain a desirable effect. This can be achieved either with the materials which are temporary and only last a few days to products which last several weeks.

Indigo is utilized as dye obtained from leaves of *Indigo tinctoria*. The best source of indigo for hair is *Indigofera argentea*. Other plants used for coloring the hair is chamomile and decoctions of woody fibres, bark, or nuts from several trees such as brazilwood (redwood), catechu (gambier), longwood (bluenwood), nutgalls (gallnuts), quercitron from oak tree (*Quercus tinctoria*), walnut (*Juglans cinerea*), etc. Their advantages over modern hair dye are that they are harmless to the scalp and cause no irritation to the skin. The disadvantage is that they do not give uniform colour and do not last for longer time.

The requirements of a good ^{hair} dye are :-

- ① It should not be injurious to human scalp, hair and skin
- ② It should dye the hair and not the scalp or skin.
- ③ It should not damage the structure of hair
- ④ It should not require long time to give coloring effect
- ⑤ It should produce lasting shades and be compatible with other hair treatments.

In addition to synthetic dye other ingredients which are used include modifiers, antioxidants, pH adjusters, surfactants, ammonia, wetting agents and fragrance

These are added in small amounts to impart special qualities to hair (such as softening the texture) or give a desired action to the dye (such as making it more or less permanent). Metal oxides such as

Titanium dioxide and iron oxide, are often used as pigments. The commonly used modifier is resorcinol, to bring out the colour tone to complement the dye pigment. The most commonly used antioxidant is sodium sulfite to protect the dye from oxidising with air. Ammonium hydroxide is a common alkalizer used to maintain the pH between 6-9 of the dye formula. Many different chemicals such as shampoos, fragrances, chemicals are added to make the formula creamy, foamy, thick, or contribute to overall action of formula.

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The hair dyes can be classified as follows

- ① Permanent hair dyes
- ② Semi-permanent hair dyes
- ③ Semi-permanent hair dyes
- ④ Gradual hair dye
- ⑤ Temporary hair dye

1) Permanent hair dyes:-

Hair colored with permanent dye would stay for 4-6 weeks and does not get removed by washing

Permanent hair dyes work on the principle of oxidation. They contain four important components: Colorless dye precursors like PPD, Oxidising agents like hydrogen peroxide (in 6% concentration), Ammonia and Coupler. Permanent hair dyes colour the hair in two steps:

First it remove the natural color of hair and secondly it apply the new hair colour. The dye precursors (PPD) are small molecules that penetrate deep into the hair shaft. Ammonia, present in the dye, facilitates their entry. Once inside the hair shaft, hydrogen peroxide first bleaches the natural colour of hair. It then oxidises the dye precursors to deposit new colour.

Permanent dyes are the most effective ones when it comes to covering 100% resistant gray hair. All hair get uniformly coloured. This, however, sometimes looks unnatural or too dark shades. With permanent hair dyes, it is also possible to get a hair colour which is of an even lighter shade than natural hair. This is because the hair is initially bleached by hydrogen peroxide to let it take over new hair colour.

Semi-permanent hair dyes:-

They are chemically milder as compared to permanent hair dyes. This is because they do not contain ammonia. Also, they have lower concentrations of H_2O_2 (2% as compared to 6% in permanent dyes). The colour molecules of semi-permanent hair dyes get deposited on the cuticle as well as penetrate into hair cortex.

The semi-permanent hair dyes cannot bleach the hair pigment that's already there. This is because they contain less amount of hydrogen peroxide. In other words semi permanent hair dyes cannot lighten the pre-existing colour of the hair. One can only go for either a similar or a darker shade than the hair colour already present. The colour is developed and deposited just like permanent hair dyes, but is washed out in 12 to 28 shampoo washes.

If the person has upto 50% gray and want to stay close to natural hair colour, one can use demi-permanent hair dyes. The colour imparted by these dyes is not as uniform as that with permanent hair colour. So, new hair growth from roots does not look as prominent and contrasting as in case of permanent hair colour. Hence, demi-permanent dyes give a more natural colour to your hair. These are gentler than permanent hair dyes, as these are less damaging to the hair shaft and less irritant to scalp. Individuals with damaged and fragile hair can use these dyes to cover grays.

Semi-permanent hair dyes

They can be either synthetic pre-formed dyes that contain direct dyes, azo, nitro amines or nitro benzenes, amino, amines and aminophenol compounds, derivative of naphthalene and anthraquinone or a natural dye like Henna, Indigo or vegetal bio colour. Being chemically milder, they are suitable for fragile and damaged hair. But these dyes have limited results. They can only blend upto 30% of gray. The colour gets washed off in 4 to 8 Shampoo washes. Also semi-permanent dyes can only darken the natural hair shade and not lighten it. Unlike permanent and demi-permanent dyes, they do not contain PPD. Thus semi-permanent dyes usually don't cause allergic reactions.

Gradual hair dyes :- They are aqueous solution of metals, which when applied on hair, leave back dark shade of metal oxide or sulphide. Such metallic dyes need repeated application over period of weeks. With each application, one can observe the gradual darkening of hair colour from grey to yellow brown to burgundy. The colour easily fades off by shampooing. Hence, gradual hair dyes need constant application.

Hair perming or straightening procedures should not be done on hair coloured with metallic dyes. These metallic hair dyes don't contain PPS. Hence these dyes are useful for individuals allergic to PPS-containing dyes.

Temporary dyes :- They consist of compounds having large sized molecules (larger than semi-permanent dyes). Due to their large size, the colour does not penetrate the hair shaft. Instead, the colour just sits outside the hair shaft, very close to hair surface. Such a colour can be washed out within one shampooing. But, on poor quality porous hair, even temporary dyes get absorbed deeper and may stay longer.

* All the Colours used must be carefully blended (4)
 so that various component do not separate into
 different tints on hair of uneven texture. The final
 product should be thoroughly tested for fastening to
 light, friction, Shampooing and other hair treatments
 especially waving and straightening. Skin patch test
 must be advised to check the sensitivity of the skin
 before usage of the hair dye product.

The commonly used formulae for Hair dye are
 as follows:

Formula 1-2

S.No	Ingredients	%(w/w)	%(w/w)
1.	Oleic/Coconut fatty acid	15	25
2.	Propylene Glycol	10	-
3.	Powdered Castile Soap	-	5
4.	Ammonium hydroxide	Q.S	Q.S
5.	Water (make to 100)	75	70

Formula 3

S.No	Ingredients	%(w/w)
1.	Water	85
2.	Monoethanolamine ^{lauryl} sulfate	5
3.	Ethylene Glycol Monostearate	5
4.	2-Nitro-p-Phenylenediamine	1.5
5.	Diethanolamine Coconut fatty acid	3
6.	Perfume/Preservative	Q.S

The FDA requires that hair dyes bear a Caution
 statement and appropriate "patch test" instructions
 for determining whether the product causes skin
 irritation to the user. It is very important to follow
 the directions on the label and to use these
 products in a safe manner only.

Oxidation Dyes

S.No	Ingredients	% (W/W)	% (W/W)	% (W/W)
1.	Intermediate Modifier	Black	Dark brown	Light brown
2.	p-Phenylene diamine	2.70	0.80	0.56
3.	p-Aminophenol	-	0.20	0.20
4.	O-Aminophenol	0.20	1.00	0.28
5.	Nitro-p-phenylenediamine	-	-	0.04
6.	2,4-Diaminodinitrobenzene Sulphate	0.40	0.00	0.00
7.	Resorcinol	0.50	1.60	0.86

Base for above Dye

S.No	Ingredients	% (W/W)
1.	Water (deionised)	100
2.	Ammonium hydroxide (28%)	10.0
3.	Sodium Sulfite	0.5
4.	EDTA	0.5
5.	Propylene Glycol	12.0
6.	Isopropanol	10.0
7.	Solubilised Lanolin	3.0
8.	Oleic Acid	20.0
9.	Oleyl Alcohol	15.0

Procedure :-

Dissolve the given dye/formula of desired shade in propyl glycol and slightly heat. Mix Oleic acid and Lanolin and stir the solution. Add Oleyl alcohol and Isopropanol with continuous mixing and add to the above mixture. Add the remaining ingredients one by one till one gets uniform mixture of the dye. Apply with dye brush on prewashed hair. Wash after waiting period of half an hour with colour protecting Shampoo.