



CHEMICAL ASPECT OF HAIR DYES OR COLORS (A REVIEW)

DR SANJAY SHARMA

CHEMISTRY DEPARTMENT, DAV COLLEGE, AMRITSAR (INDIA)

ABSTRACT

Hair coloring is common in all the generations and all regions of the world. All persons of the young generation (fashion) as well as the older generation who wish to hide their gray hair, use hair dyes or colors. To keep in mind the utility of these colouring products many researchers have been done to improve the quality and to minimize the damage to the hair.

Hair consists of three parts at the base is Bulb, above this bulb is Root which lies below the skin, the outermost visible part of hair is Shaft. The dyes are used to color the shaft portion of hair. With the growth of the hair the grey colored hair starts visible at the base, so one has to apply color again and again to have a uniform look of hair.

In the market there are available certain natural dyes, these dyes do not contain oxidising agents so with these dyes sensitization and irritation do not usually occur.

KEYWORDS

Hair dyes, Hair shaft, Natural dyes, Permanent dyes

Hair is an approximately cylindrical protein filament, lengthwise it has three parts; **Bulb, Root and Shaft.**

Bulb lies at the base in the dermis, **Root** is the hair lying below the skin surface and **Shaft** is the hair above the skin surface. It is believed to be a dead structure composed of cells which die after leaving the dermal papilla. It has a keratinized structure composed of an outer cuticle, the cortex where cells are held firmly together and an inner medulla where the cells are larger, more loosely connected and partially separated by air spaces (Arase et al., 1991). The colors and dyes are used for the shaft of hair.

Depending upon the time up to which the effect of colouring agent lasts, the products can be categorized into permanent, demipermanent, semi-permanent, temporary and color refreshers.

The permanent coloring lasts until the hair grows out, demi-permanent lasts up to 24 washes, semi-permanent lasts for six to eight weeks, and temporary lasts for one to three washes. (Rough et al., 2002). The color refreshers are temporary dyes applied to counteract the fading of permanent and semi-permanent dyes.

Permanent Hair Dyes

For the permanent coloring hydrogen peroxide is being used, it bleaches the natural hair color. This oxidant (or developer) then oxidizes the dye precursor (or dye intermediate) to develop the color.

Semi-Permanent Hair Dyes

These are the direct dyes and do not involve oxidation. The color of the applied dye solution is the color that will be produced on the hair. Two major dyes used for semi-permanent hair coloring are:

- Nitrobenzene dyes (e.g. 2-nitro-p-phenylenediamine, HC yellow 2, HC orange 1, HC blue 2) and
- Disperse dyes (e.g. Disperse Blue 1, HC Blue 8, HC Yellow 7).

Temporary Hair Dyes

Typically, temporary hair dyes are removed after one or two shampoos. These dyes do not damage the hair by oxidation and bleaching and that they usually are easier to apply. These dyes do not penetrate the hair shaft and have a wide variety of colors which are brighter in look. These dyes can be removed by washing the hair with shampoo. These dyes can be incorporated into various hair dyeing products including

hair rinses, colored hair sprays, styling gels and lotions, and color refreshers.

Color refreshers are used to counteract the fading of permanent and semipermanent dyes.

Natural Dye (Henna)

Henna is a natural dye extracted from the dried and powdered henna shrub (*Lawsonia inermis*). The powdered dried leaves are greenish in color, but when mixed with water it forms a semisolid paste which adheres to the hair and the color of dye is reddish to dark brown. Strong tea or coffee, lemon juice (or other acidic liquid) and essential oils (such as tea tree, eucalyptus, clove and lavender) can be used to release the dye from the powder. Henna stains the hair temporarily for about 2-4 weeks. To create various shades with henna, another pigment, paraphenylenediamine (PPD), is often added. In rare cases, it can induce allergic reactions.

Other Natural Hair Dyes

A number of other natural colors are available for hair dyeing. These are indigo, logwood, Brazilwood and chamomile. They may naturally contain oxidizable phenolic substances. With these only low intensity coloration is produced. In order to have intense color the dye has to be applied again and again. Due to absence of oxidising agent in these natural dyes sensitization and irritation do not usually occur.

Coloring process

As shaft of human hair is proteinaceous (keratin) it contains a large percentage of oxidizable groups. The external layer of the hair, called the cuticle, contains a few polar groups, (strongly hydrophobic) and contains negatively charged ionic groups (Förster & Schwuger 1990).

The reaction step of the dye with the hair fibers (shaft) has four phases:

1. Diffusion through solution
2. Adsorption or interaction at the fiber surface
3. Diffusion or transport into the fibers
4. Reaction at internal sites in the fibers.

The color of the hair is a result of the diffusion of dyes into the hair shaft. The diffusion of dyes into the hair fibers depends upon the temperature, molecular size of the dye, cross-linking density of the fibers. Exposure time plays a critical role in color deposition (Robbins, 1994).

In the presence of an oxidative dye (permanent hair coloring), there is oxidative degradation of disulfide bonds to polar sulfonic acid groups, it causes the damage of hair as degradation process is irreversible.

The small quantity of dye enter the hair shaft in case of semi-permanent hair coloring, so dye can easily leave the hair shaft as the hair is washed (Herman, 2000).

In temporary coloring (cationic dyes) the dye molecules are too large to enter the hair shaft so the molecules stick onto the hair shaft as a result of the net negative charge on the hair surface. Since the temporary dyes stick to the surface of the hair, it is easily removed by one to three washes. However, if the hair has been chemically treated (e.g. permanent hair coloring) prior to the application of the temporary dye, the hair becomes more porous and allows the dye to penetrate into the hair shaft, resulting in the hair color to last longer.

CONCLUSION

In the modern era where physical look matters a lot, people of all generations are using hair colors and dyes. The younger are using for fun and elders are using to hide their grey hair. In market hair colors of different qualities are available, but only the products of good brands should only be used and moreover there are available natural dyes these dyes are safe for use and so they may be opted.

REFERENCES

- Arase S., Katoh S., Sadamoto Y.(1991). Culture of human outer root sheath cells from plucked hair follicles in serum free conditions, *J. Dermatol. Sci.*, 2: 66-70 | | Förster, Th.; Schwuger, M. J. (1990). "Correlation between adsorption and the effects of surfactants and polymers on hair" *Progress in Colloid & Polymer Science*, 83, 104-109 | | Herman, S. "To dye for" *Global Cosmetic Industry* 2000, 167(4), 46-47 | | Rough, H.; Drake, D.; Robinson, J. (2002). "Hair colourants – dyeing for a change" *Speciality Chemicals Magazine*, November Issue, 18-19 | | Robbins, Clarence R.; *Chemical and Physical Behavior of Human Hair*, 3rd Edition. (1994). Springer-Verlag New York, Inc. |