

Chemistry & Formulation of Para- phylene diamine (PPD) based hair dye.



Haircoloring



Introduction

- Nearly all adults and teenagers now color their hair.
- Everyone want to enhance their hair color, change their hair color, or cover gray.



Why People Color Their Hair?

- Cover up or blend gray hair
- Enhance existing hair color
- Create a fashion statement or statement of self-expression
- Correct unwanted tones



Hair color vs. Haircolor

Hair color – Refers to the natural color of the hair.

Haircolor – a professional, industry-coined term referring to products and services for artificially coloring the hair.

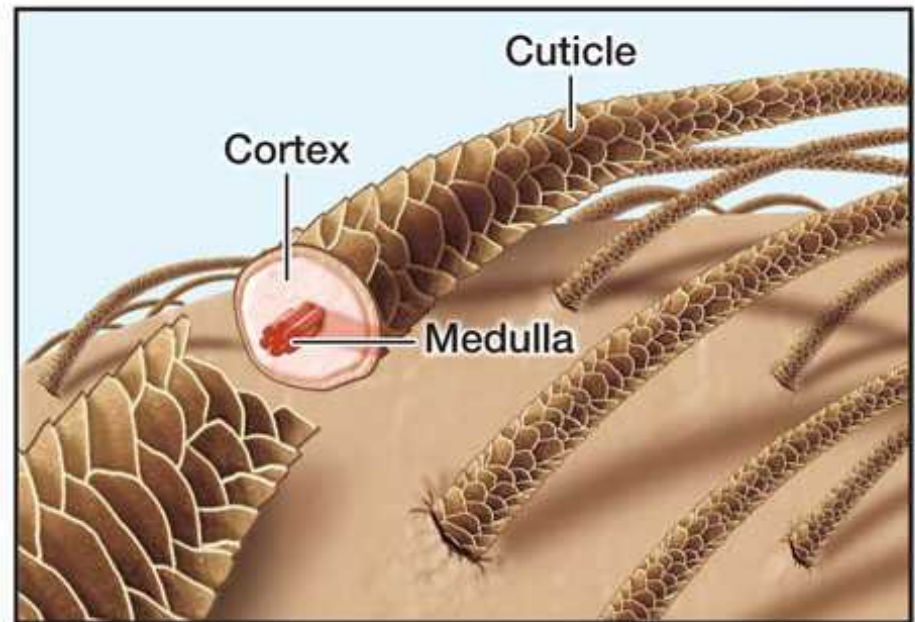


The structure of the hair

Cuticle – outermost layer that contributes 20 percent of overall strength

Cortex – middle layer that contributes 80 percent of overall strength

Medulla – innermost layer (sometimes absent)

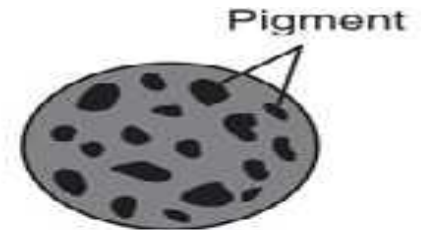


Hair Texture

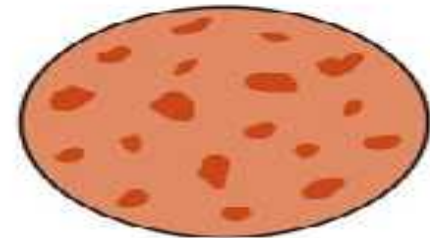
Coarse – large hair-strand diameter

Medium – medium hair-strand diameter

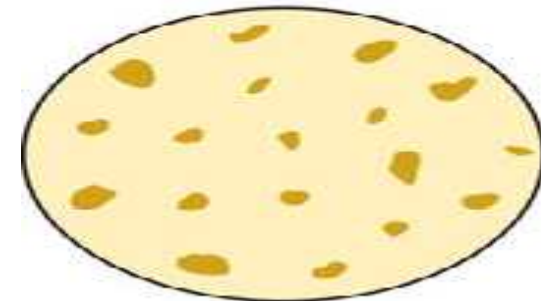
Fine small hair-strand diameter



Fine textured hair



Medium textured hair



Coarse textured hair



Hair Density

Number of hairs per square inch

Refers to hair thickness



Porosity

The ability of the hair to absorb moisture

Porous hair accepts haircolor faster and permits a darker color than less-porous hair.



Types of Porosity

Low porosity – tight cuticle, **resistant** hair

Average porosity – cuticle slightly raised; average processing time

High porosity – cuticle lifted; quicker processing time

Test for porosity – finger and thumb test



Gray Hair

The loss of pigment increases with age.

Most people retain a certain percentage of pigmented hair.

Gray hair can be solid or blended and requires special attention during haircoloring.



Ideal characteristics of hair colors

- ✓ **Not injure hair shaft**
- ✓ **Non-irritant & free from sensitization**
- ✓ **Not have systemic toxicity**
- ✓ **Color of dyed hair: stable to physical factors**
- ✓ **No effect of shampoos, brilliantines, setting lotions on the dyed hair.**
- ✓ **Stable in the formulation sold in market**
- ✓ **Color hair without reducing natural gloss**
- ✓ **Not change the texture of hairs**





Formulation

- ✓ **Dyes**
- ✓ **Modifiers**
- ✓ **Antioxidants**
- ✓ **Alkali**
- ✓ **Soaps**
- ✓ **Ammonia**
- ✓ **Wetting agents**
- ✓ **Fragrance**

Understand the Types of Haircolor

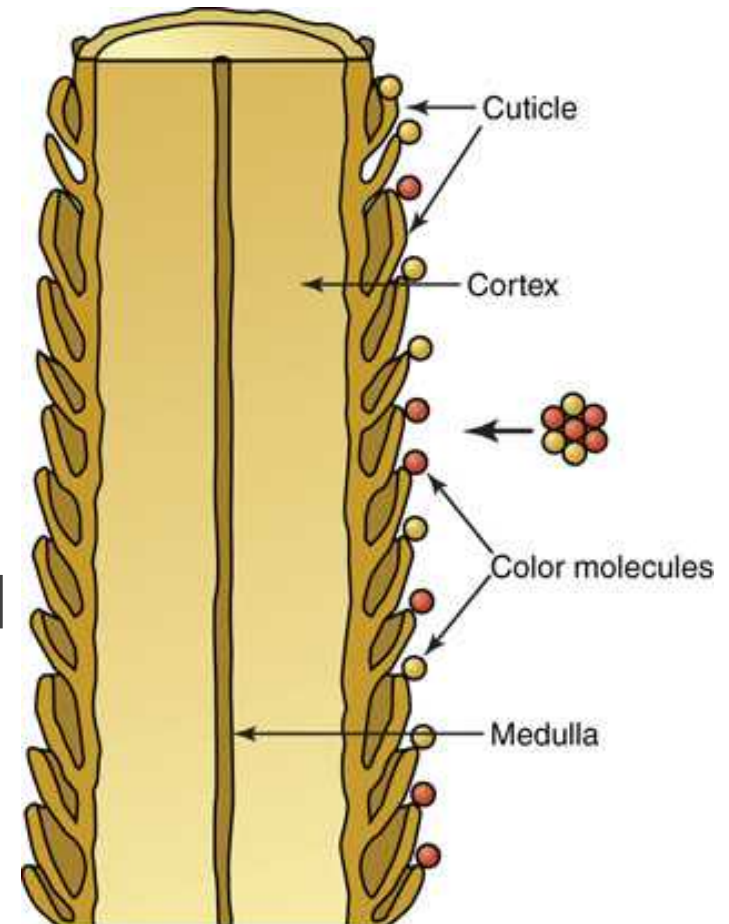
- Nonoxidative haircolor
- Oxidative haircolor
- Lighteners, metallic haircolors, and natural colors
- Developer and an alkalizing ingredient

Types of hair color

- ✓ Temporary hair color
 - ✓ Semi permanent hair color
 - ✓ Permanent hair color
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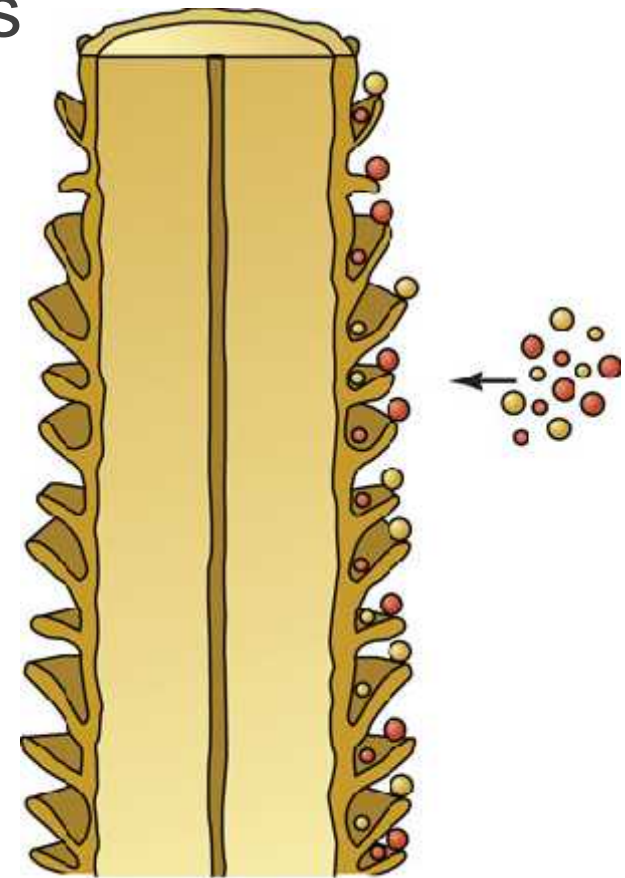
Temporary Haircolor

- Does not penetrate cuticle layer
- Coats hair shaft
- Neutralizes unwanted tones
- Available in variety of colors and products



Semipermanent

- Lasts through several shampoos
- Penetrates hair shaft; stains cuticle layer
- Fades with each shampoo
- Nonoxidation
- Used out of bottle; requires patch test



Semi permanent hair color

- ✓ Give stronger & more permanent coloration to hair
- ✓ Some colors are removed in 4-8 shampoos.

Dyes used are:

- ✓ Nitrophenylenediamine,
- ✓ Nitroaminophenols,
- ✓ Aminoanthraquinones.



Dye intermediates in semi-permanent hair dyes

Dye intermediates in semi-permanent hair dyes

Shades	Name of dye intermediate
Yellow	4 - nitro- m- phenylene diamine
Orange	2 - amino- 4- nitrophenol
Red	4 - (2- hydroxy ethyl) amino- 3- nitrophenol
Violet	1 - 4 - diamino-5- nitro- anthraquinone

Permanent Haircolor

- Contains ammonia, oxidative tints, and peroxide
- They require a patch test 24 to 48 hours prior to tints.
- Contains aniline derivatives

Combine with H_2O_2 to form larger molecules

- Removes natural pigment while adding artificial color

Best to cover gray



Permanent Haircolor

- Ammonia (or ethanolamines in the case of some ammonia-free products),
- Hydrogen peroxide, and
- p-phenylenediamine.
- The ammonia pulls apart layers of the hair's proteins, so that the dye can access the hair shaft.
- Next, hydrogen peroxide bleaches the hair and helps p-phenylenediamine (PPD), one of the primary coloring agents, to become trapped in hair.

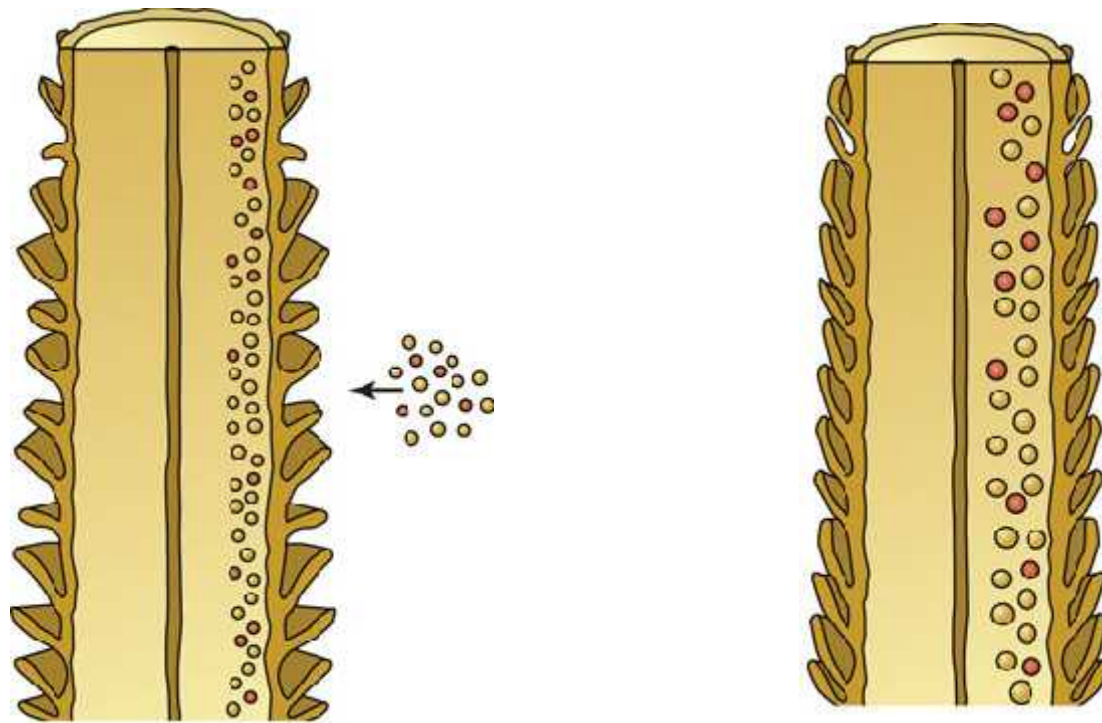
Permanent color

All "permanent" haircolor products and lighteners contain both a developer, or oxidizing agent, and an alkalizing ingredient as part of their ammonia or an ammonia substitute.

When the tint (color) containing the alkalizing ingredient is combined with the developer (usually hydrogen peroxide), the peroxide becomes alkaline and diffuses through the hair fiber, entering the cortex, where the melanin is located.

The lightening occurs when the alkaline peroxide breaks up the melanin and replaces it with new color

Permanent Haircolor Action



Natural Haircolor

From leaves or bark of plants

No lightening

Limited shade range

Professional products cannot be applied over



Metallic Haircolors

Also known as gradual haircolors

Contain metal salts that change hair color gradually by progressive buildup and exposure to air, creating a dull, metallic appearance



Health Hazards

- Hair dyes can cause **allergic reactions**
- *para*-phenylenediamine (PPD). also known as a skin sensitizer
- Short-term exposure of PPD can result in skin and eye irritation, and asthma
- more serious impacts like vertigo, convulsions, and coma.