

# USES OF ONION (*Allium cepa* L.) & ALOE VERA (*Aloe barbadensis* Miller) POST HAIR DYE TREATMENT

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**Abstract:** Human hair is composed of proteins, lipids, water, melanin and it presents three principal components i.e., cuticle, cortex and medulla. The different stages of hair growth are anagen, catagen and telogen phases. Hair growth can be affected by the use of certain hair dyes and may cause hair damage too. In present work, we have studied the hair protecting effect of Onion and Aloe vera which can possibly be used to prevent the hair from getting damaged by various hair dyes. This article highlights the human hair and its growth cycle and brief information about the chemical constituents and properties related to the hair protectants.

**IndexTerms:** Human Hair, Hair dye, Hair Care, Keratin, Onion, Aloe vera, Disulphide Bond, Oxidising agent.

## I. INTRODUCTION

### 1.1 HUMAN HAIR

The human hair is composed of protein, lipid, water, melanin and trace elements. The main constituents of hair are of  $\alpha$ -keratin, a group of proteins which account for 65%-95% of hair weight. It is responsible for conferring mechanical properties such as elasticity, shape, strength and functionality (1).

The human hair presents three principal components: cuticle, cortex and medulla which are respectively from outside to inside. The cuticle is composed of protein material and amorphous, and it is located in the outer portion of the hair fibre and consists of enucleate cells, translucent and flattened. Morphologically, the cuticle is composed of 6 to 8 cell layers overlapped in the longitudinal direction of the fibre. The overlapping cell adherence provides the physical properties of hair with reflection light and reduces the friction between the fibres being responsible for the properties of gloss and combing, respectively. Cosmetic treatments, such as conditioners, hair sprays, mousses and gels, alter the properties mentioned above because they are deposited on the cuticle layer. However, dyes and straightening products due to the alkaline pH of the cuticle open up the layers for the active principles or dyes penetrate and act in the cortex, reducing the size or altering the colour of hair. The cortex is a major constituent of the hair fibre (75%). Cortical cells are subdivided into macrofibrils formed per material interfilamentar amorphous rich sulphur and microfibrils arranged in  $\alpha$ -helix, consisting of four protofibrils, and these two protofilaments, dimers possessing two  $\alpha$ -keratin subunits. The  $\alpha$ -keratin presented in the microfibrils determines the mechanical properties of fibre, such as strength and elasticity. In the same way as the cuticle, it has cells filled by cross links of cystine and others cells separated by the cell membrane complex (CMC). The medulla is a thin cylindrical layer at the centre of the hair thread may or may not be present; it is presented only in terminal hair and its role is not clearly defined (1) (2) (3).

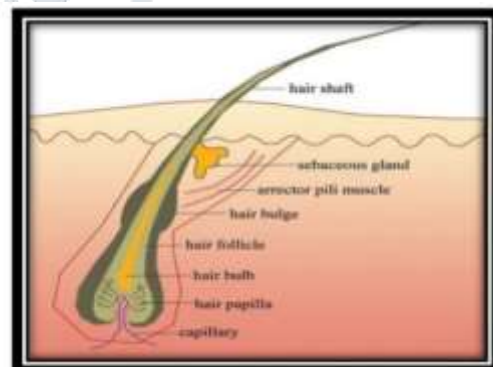


Fig: Morphology of Hair (4)

Hair is an annex of the epidermis and covers the external tissues of most mammal. It is also considered an adornment. It works as a thermal regulator and protects the head and the skin from the sun due to the presence of melanin (4). Humans have between 90 and 150 thousand of hair fibres on the scalp that grow 1 cm/month (0.37 mm/day), and the normal amount of hair lost is between 50 and 100 fibres per day. The hair diameter varies from 15 to 110  $\mu$ m, depending on the race (5). Caucasian hair is usually thin and fine, may have waves, and is circular under the cross-section view (ellipticity of 1.25). The African hair type (wavy to curly) has a larger diameter, with a slightly oval cross-section (ellipticity of 1.75). Lastly, Mongolian hair also has a larger diameter but varies from flat to wavy with a cross-section similar to Caucasian hair (ellipticity of 1.35) (6) (7).

Hair or fur is composed of dead skin cells which pass through a keratinization process, derived from hair or hair follicles that are invaginations that protrude into the dermis or hypodermis (8). Keratin, the main protein found in the hair fibre, is produced by the keratinocytes of the epithelial tissue invagination. Small amounts of water-soluble substances are also present, such as pentene, phenols, uric acid, glycogen, glutamic acid, valine and leucine (9).

The hair shaft is divided into four main distinct structures: cuticle, cortex, cell membrane complex (CMC), and the medulla (10).

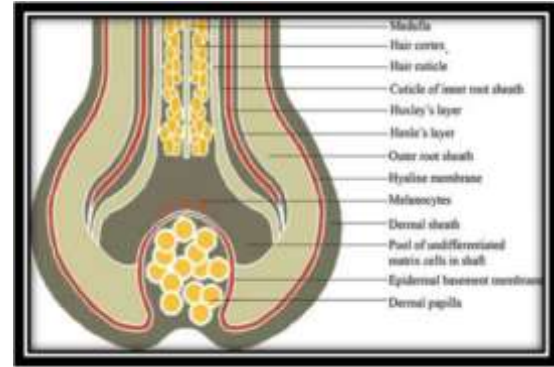


Fig: Internal Structure of Hair (11)

The cuticles (which consists of amorphous and protein material) are the most external part of the hair strand and ensure chemical resistance. These cuticles carry out the function of regulating the amount of water in the hair structure, which keeps its physical properties. It contains six to ten layers of overlapping cells in the longitudinal direction of the fibre (12). The damage to the cuticle can be caused by weather or mechanical friction such as combing and brushing. The excessive use of shampoo and other inappropriate cosmetics may damage hair (13). Each cuticle cell contains an external thin membrane (5.0 to 10.0 nm) probably formed by a layer of fatty acid connected to the protein layer through thioester bonds, which generates cysteine residues responsible for the apparent hydrophobic character of the fibre (12).

The cuticle contains three important layers: the A-layer (120 nm) with a high content of cysteine and highly cross-linked; the exocuticle (B-layer), also rich in cysteine and occupying about the half of the cell volume; and, finally, the endocuticle, a layer with a low content of cysteine and relatively high levels of basic (lysine, arginine) and diacids (aspartic and glutamic acids) amino acids (6) (14).

The cortex is the principal component of the hair, consisting of cylindrical cells of about 1 to 6  $\mu\text{m}$  of thickness and 100  $\mu\text{m}$  of length. It forms the matrix where other proteins and keratin are located, and composes the larger part of the fibrous mass of human hair, being formed by intracellular and intercellular material (15). The cortex represents 90% of its total weight and consists of cells filled with keratin, with an organization that provides mechanical properties to the fibres (16). The cortical cells, adjacent to the cuticle, are flatter and contain less sulphur than the cells inside the cortex, which are rich in cysteine (two cysteine), amino acids, lysine and histidine, in addition to the melanin granules (6).

The matrix comprises the major structure of the hair and contains a high concentration of disulphide bonds. It presents considerable swelling when in contact with water and forms a lightly cross-linked gel structure. Although there are amorphous regions, the matrix presents small parts with structural organization (17). It exhibits keratin microfibrils aligned in the direction of the hair strand and melanin granules which are responsible for the hair colour and its photo protection.

### 1.1.1 GROWTH CYCLE

The three stages of hair growth are the anagen, catagen, and telogen phases. Each strand of hair on the human body is at its own stage of development. Once the cycle is complete, it restarts and a new strand of hair begins to form. The growth rate of hair varies from individual to individual depending on their age, genetic predisposition and countless environmental factors. It is commonly stated that hair grows about 1cm per month on average; however, reality is more complex, since not all hair grows at once. Scalp hair is known to grow between 0.6 cm and 3.36 cm per month. The growth rate of scalp hair somewhat depends on age (hair tends to grow more slowly with age), sex, and ethnicity. It was previously thought that Caucasian hair grew more quickly than Asian hair and that the growth rate of women's hair was faster than that of men (18). However, more recent research has shown that the growth rate of hair in men and women does not significantly differ (19) and that the hair of Chinese people grew more quickly than the hair of French Caucasians and West and Central Africans (20).

### ANAGEN PHASE

The anagen phase, known as the growth phase, is when the hair physically grows approximately 1 cm per month (21). It begins in the papilla and can last from three to five years (22). The span at which the hair remains in this stage of growth is determined by genetics. The longer the hair stays in the anagen phase, the longer it will grow. During this phase, cells neighbouring the papilla in a germinative layer divide to produce new hair fibres, (23) and the follicle buries itself into the dermal layer of the skin to nourish the strand. About 85%–90% of the hairs on one's head are in the anagen phase at any given time.

## CATAGEN PHASE

The catagen phase, or the transitional phase, allows the follicle to renew itself (in a sense). During this time, which lasts about two weeks, the hair follicle shrinks due to disintegration and the papilla detaches and "rests," cutting the hair strand off from its nourishing blood supply (24). Signals sent out by the body (that only selectively affect 1 percent of all hair of one's body at any given time) determine the start of melanin production in the hair bulb and apoptosis of follicular melanocytes. Ultimately, the follicle is 1/6 its original length, causing the hair shaft to be pushed upward.

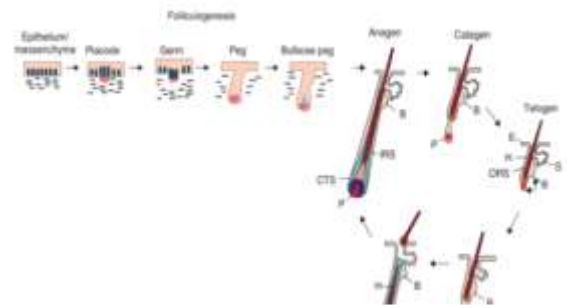


Fig: Hair Growth Cycle (72)

## TELOGEN PHASE

During the telogen or resting phase (also known as shedding phase) the follicle remains dormant for one to four months. Ten to fifteen percent of the hairs on one's head are in this phase of growth at any given time. In this phase, the epidermal cells lining the follicle channel continue to grow as normal and may accumulate around the base of the hair, temporarily anchoring it in place and preserving the hair for its natural purpose without taxing the body's resources needed during the growth phase.

At some point, the follicle will begin to grow again, softening the anchor point of the shaft initially. The hair base will break free from the root and the hair will be shed. Within two weeks, the new hair shaft will begin to emerge once the telogen phase is complete. The process results in normal hair loss known as shedding (25).

## 1.2 HAIR DYE

Since the beginning of human civilization, humans are known to use cosmetics, combination of natural materials like herbal, animal fat substances etc., (26) (27). Original hair colour changes by application of chemical/ dye are a common practice among the men and women (28). Natural dyes play a crucial role in human life (29). Earlier days natural dyes were used for colouring the clothes, cosmetic, medicinal and another purpose due to biodegradability and environmental concern, in recent days natural platform is very much pronounced. Natural dyes are having higher biodegradability, are eco-friendly and are safer to human. Nowadays, hair dyes are in the important phase of development and significant progress in discoveries and application of many new synthetic dyes has occurred. Hair dyes are classified into two categories, they are oxidative hair colour and non-oxidative hair colour. Classification based on the oxidation behaviour of dyes (30). Some of the hair colour/ dyes directly deliver the colour without any oxidizing agent and those category dyes/colours are called as "non-oxidative" dyes. Almost 90% of the market sold hair colour are oxidative hair colour category because these products were containing the oxygen release in the formula. The releasable oxygen will be of immense use to oxidize the dye material and ignite the reaction mechanism and form a desired colour to the hair (31). Cream and lotion-based hair colours are familiar with European market. Various types of oxidizing agents are available, liquid form of oxidizing agents are used for the cream and lotion based hair colour and hydrogen peroxide is the best example of the liquid form of the oxidizing agent. The powder form of hair dyes is also familiar in Asian countries, in Asian countries, they have added the dye material and other required chemicals in the henna-based formula. The powder form of dyes diluted with water to make it of applicable consistency. During the dilution time, the oxygen molecule is released when the powder reacts with water. The releasable oxygen further reacts with dye molecule and promotes the colouring mechanism. Barium peroxide, calcium peroxide, sodium perborate, potassium peroxide and sodium peroxide, etc., are the best example of the powder form of oxygen release. The concentration of oxidizing agent plays a crucial role in the reaction mechanism, higher concentration speeds up the reaction mechanism and fastens the colour delivery (31) (32).

### 1.2.1 TYPES OF HAIR DYE

Hair dyes are broadly classified into the following category based on their colour resistance property, namely temporary, semi-permanent, demi-permanent and permanent (33).

## TEMPORARY HAIR COLOUR

Temporary dyes are otherwise called as non-oxidative dyes, because colouring process was carried out without any oxidizing agent, it reduced stay time on the fibre, removing the hair during the first shampoo wash. Temporary colouring molecules have the high molecular weight and deposits on the hair surface only and not penetrate on the cortex (15). Temporary hair colour does not bleach the original hair strand i.e., it does not have the power of lightening/ whitening the hair (33).



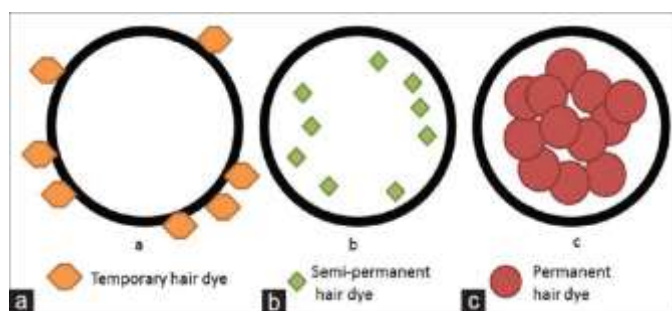


Fig: Penetration power of different types of hair dyes

Temporary colours are applied for developing the fashion colours, usually used one level lighter than the original hair colour, if the original colour is black background, the colour is not visually seen. Temporary colours are not useful to deliver the 100% grey coverage and are used to hide or change the hair colour tone (15). A temporary colour covers the 15% grey hairs only, because it does not penetrate to the cortex due to higher molecular weights. Temporary colours have the acid characteristics usually having the higher molecular weight and some commonly used temporary colours are listed in Table 1. Temporary colours have anionic characteristics and higher solubility in water; therefore, it gets easily removed by first shampoo washing (33). In general, higher concentrations of temporary colours are used for delivering the desired colour, because shampoo wash easily removes the excess amount of dye molecules. Temporary colours also are used as a uniform colour to achieve the optimum colour delivery with continuous application. It is suitable for those who wish to apply the fancy/ fantasy colours to their hair (34).

Table 1: Some examples of Temporary Hair colour

### SEMI-PERMANENT HAIR DYE

The term Semi-Permanent hair dye refers to those products that dye the hair lasting through 4-6 shampooing and do not use hydrogen peroxide to develop the hair colour. Semi-Permanent hair dye products consist of nitro aromatic amines or aromatic amino-nitro-anthraquinone dyes that diffuse into the hair and bind to the hair, however do not attach firmly.

INCI name	CI number	CAS Number	Deliver color/shade
Acid yellow 23	CI19140	1934-21-0	Yellow
Acid orange No. 7	CI15510	633-96-5	Orange
Acid yellow No. 1	CI10316	846-70-8	Yellow
Acid red. 33	CI17200	3567-66-6	Red
Acid red 92	CI45410	4618-23-9	Red
Acid violet 43	CI60730	4430-18-6	Violet
Acid blue 9	CI42090	3844-45-9	Blue
Acid black 1	CI20470	1064-48-8	Black

Because these dyes are not tightly bound, they diffuse out of the hair after a few shampoos washing. Semi-Permanent hair dyes are generally applied to freshly shampooed hair and allowed to remain on the hair for approximately 20 min. and hair is then rinsed with water. Often a "conditioner", packaged with the product, is applied and the hair is rinsed again and then dried. Robbins and Crawford exclusively studied and confirmed this finding in a study of the diffusion of HC red 3 into the hair. These workers found that the weak binding bond formed between mononuclear dye and hair, is the reason the shampoo washing easily removes it.

Demi-permanent hair colour products are having higher shampoo resistance pattern when compared to the semi-permanent dyes (resistance up to 20 washes), because demi-permanent dye molecules are applied with hydrogen peroxide or other oxygen releasing agent without alkali solution. Robbins and Crawford (5) and Brown (35) exclusively studied the diffusion pattern of demi-permanent colour and found that weak Van der Waals bonds are formed between in demi-permanent colouring mechanism.

### DEMI-PERMANENT HAIR DYE (36)

Demi-permanent hair colour is hair colour that contains an alkaline agent other than ammonia (e.g., ethanolamine, sodium carbonate) and, while always employed with a developer, the concentration of hydrogen peroxide in that developer may be lower than used with a permanent hair colour. Since the alkaline agents employed in demi-permanent colours are less effective in removing the natural pigment of hair than ammonia these products provide no lightening of hair's colour during dyeing. As the result, they cannot colour hair to a lighter shade than it was before dyeing and are less damaging to hair than their permanent counterpart.

Table2: Some Semi-permanent hair colour examples

INCI name	Deliver colour/shade
2-nitro-p-phenylenediamine	Red
4-nitro-o-phenylenediamine	Yellow orange
HC red No. 3	Red
HC yellow No. 2	Yellow
HC yellow No. 4	Yellow
HC blue No. 1	Blue
HC red No. 1	Red
HC orange No. 1	Orange
Disperse black 9	Black
Acid orange 3	Orange
Disperse violet 1	Violet

Demi-permanents are much more effective at covering grey hair than semi-permanents, but less so than permanents.

Demi-permanents have several advantages as compared with permanent colour. Because there is essentially no lifting (i.e., removal) of natural hair colour, the final colour is less uniform/ homogeneous than a permanent and therefore are more natural looking; they are gentler on hair and therefore safer, especially for damaged hair; and they wash out over time (typically 20 to 28

shampoos), so root regrowth is less noticeable and if a change of colour is desired, it is easier to achieve. Demi-permanent hair colours are not permanent but the darker shades in particular may persist longer than indicated on the packet.

## PERMANENT HAIR DYES

Permanent hair dyes are called oxidation hair dyes, because of the oxidizing agent used for the colour development. Permanent hair dyes were generally containing p-diamines and p-amino phenols that are oxidized in the presence of oxygen releases like hydrogen peroxide, barium peroxide, calcium peroxide, etc., and form active intermediates. An active intermediate reacts further with coupler and provides the colour to the hair and in general oxidation hair dyes provides shampoo resistant hair dyes. Permanent hair dyes are otherwise called as an oxidative hair dye (5).

Corbett exclusively studied the review of the chemistry of oxidative dyeing mechanism. These reactions are usually carried out at alkaline pH, generally from 8-10 (35) (37). By adjusting the proportions of pH, peroxide, precursors and couplers, the hair may be made lighter or darker in one process. Morel et al. (38) exclusively studied the permanent colouring mechanism and found that the colour formation involves a tedious reaction between the precursors and the oxidizing agent. Precursors can be further classified into two categories: Oxidation basis or Primary intermediaries and the Couplers or Reaction modifiers (35).

The pH of the dye mixture plays a crucial role in a permanent colour mechanism, higher pH/ alkaline medium promotes the opening of the cuticle and is beneficial for the penetration of dye molecules into the cortex in a fast manner. However, the initial reaction was ignited by the oxidizing agent and the reaction occurs in the cortex of the hair. Some reaction also takes place in the outer layer of the hair i.e., cuticle and it was easily removed by the first washing with shampoo (39) (40). Oxidizing agent concentration also plays a crucial role in the colouring reaction mechanism. Ammonia hydroxide, amino ethyl propanol and ethanol amines are regularly used alkalizing agents. Similarly hydrogen peroxide, calcium dioxide, sodium perborate, barium peroxide act as an oxidizing agent. Hydrogen peroxide directly releases the oxygen molecule. However, the powder form of oxidizing agents like sodium perborate, calcium peroxide, barium peroxide, etc., releases the oxygen molecule whenever it reacts with water. A small quantity of surfactants and solvents are also used in hair colour products, the solvents used for wetting the hair are immensely useful for dissolving the dye material. Surfactant helps to remove the excess amount of dye molecule/ unreacted species dye molecule in cuticle layer and also contributes in removing the stain on the scalp and forehead during the colouring time. Final product contains the reducing agent, it will help to prevent the oxidation reaction between the dye material during the shelf life period, in general sodium sulphite, ascorbic acid, etc., act as reducing agents, however, higher concentration of reducing agent prevents the oxidation reaction, therefore the dosage of reducing agent is critical one. PPD (p-Phenylenediamine) undergoes oxidation and forms diamine and amine derivatives and one of the hydrogen molecules moves and forms double bond structure and is described in figure given below. Couplers are aromatic compound and is derived from benzene, substituted by at least two electron donor groups such as NH<sub>2</sub> and OH in para or ortho positions to confer the property of easy oxidation, acting as a colour developer (40).

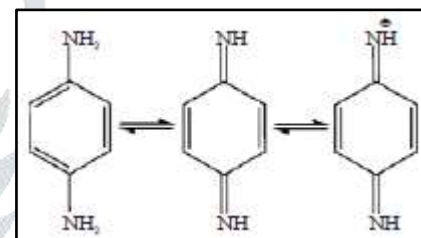


Fig: Resonating Structures of p-phenylenediamine

### 1.2.2 APPLICATION TECHNIQUES

#### OFF-SCALP (41)

Hair colour was traditionally applied to the hair as one overall colour. The modern trend is to use several colours to produce streaks or gradations, but not all work on top of a single base colour. These are referred to as:

- Highlighting, where sections of hair are treated with lighteners
- Lowlighting, where sections of hair are treated with darker hair colours
- Splash lighting a horizontal band of bleached hair from ear to ear

There are also newer colouring techniques such as ombré, shatush, balayage, air touch, in which hair is dark on the crown and bit by bit becomes lighter toward the ends.

These are off-the-scalp techniques, and can be applied by the following methods:

- Foiling, where pieces of foil or plastic film are used to separate the hair to be coloured. Employed especially when more than one colour is to be applied, this method ensures that only the desired hair strands are coloured, and the rest spared
  - Cap, when a plastic cap is placed tightly on the head and strands are pulled through with a hook, a method infrequently practiced other than for applying highlights to short hair
  - Balayage, where hair colour is painted directly onto sections of the hair with no foils used to keep the colour contained, a method growing in popularity due to its observed effect of appearing more natural. The difference between balayage and Ombre is that a balayage requires more precise hand-painting sections of hair and typically costs more

- Dipping or tip dyeing, similar to balayage in that the colour is painted directly on the hair, resulting in a more uniform colour coverage on hair ends

### ON-SCALP (36)

Hair colouring can also be applied on the scalp for a more solid level of coverage

- Root touch-up, where colour is applied only to the most recent section of re-growth (usually the first inch of hair nearest the scalp) Root touch-ups are repeated every 4–6 weeks as the natural colour grows in and becomes apparent. People who colour their hair to disguise grey often have these root touch-ups
  - All-over colour, where the person wants all of their hair to be a different solid colour
  - Block colouring, where the person wants two or more colours applied to their hair, resulting in dimension and contrast

All colouring techniques can be used with any type of colour. For lightening, the hair sometimes has to be bleached before colouring

### 1.2.3 MAINTAINING HAIR COLOUR

There are many ways that people can maintain their hair colour, such as:

- Using colour-protecting shampoos and conditioners
- Using sulphate-free shampoo
- Using purple shampoos and conditioners to maintain or enhance the blond colour in their hair
- Using leave-in treatments with UV absorbents
- Getting deep-conditioning treatments to smooth and add lustre
- Avoiding chlorine
- Using heat protecting products before using styling appliances

### 1.2.4 ADVERSE EFFECTS

Hair colouring involves the use of chemicals capable of removing, replacing, and/or covering up pigments naturally found inside the hair shaft. Use of these chemicals can result in a range of adverse effects, including temporary skin irritation and allergy, hair breakage, skin discolouration and unexpected hair colour results. According to the International Agency for Research on Cancer (IARC), in vitro and in vivo studies (in exposed human populations) have shown that some hair dyes and many chemicals used in the hair dyeing process can be considered mutagenic and carcinogenic (42) (43).

### SKIN IRRITATION AND ALLERGY (44)

In certain individuals, the use of hair colouring can result in allergic reactions and/or skin irritation. Individuals allergic to gluten for example, will need to be cautious when purchasing hair colour since certain hair dye includes gluten. Gluten does not need to be ingested for it to cause an allergy. Skin contact with gluten may cause a reaction; therefore, leading to an allergy. Symptoms of these reactions can include redness, sores, itching, burning sensation and discomfort. Symptoms will sometimes not be apparent immediately following the application and processing of the tint, but can also arise after hours or even a day later.

To help prevent or limit allergic reactions, the majority of hair colour products recommend that the client conduct a patch test before using the product. This involves mixing a small quantity of tint preparation and applying it directly to the skin for a period of 48 hours. If irritation develops, manufacturers recommend the client to not use the product.

European dermatologists have, however, strongly advised against such pre-use testing, as it entails additional sensitisation (allergy) risk and the interpretation by laypeople may not be sufficiently accurate.

### SKIN DISCOLOURATION (45)

Skin and fingernails are made of a similar type of keratinized protein as hair. That means that drips, slips and extra hair tint around the hairline can result in patches of discoloured skin.

This is more common with darker hair colours and persons with dry absorbent skin. That is why it is recommended that latex or nitrile gloves be worn to protect the hands.

This discolouration will disappear as the skin naturally renews itself and the top layer of skin is removed (typically takes a few days or at most a week). Ways of preventing skin discolouration are to wear latex or nitrile gloves to protect the hands and also by applying a thin layer of petroleum jelly or oil-based preparation around the hairline. Gentle abrasives such as moist baking soda or a small amount of toothpaste applied with a toothbrush may also help remove the uppermost layer of skin and dye (neither removes just the dye). Acetone and nail polish remover

are not considered effective; laundry detergent may sometimes work as may moist cigarette ash rubbed into the stained area.

## II. BRIEF OVERVIEW OF ONION AND ALOE VERA

### 2.1 ONION

#### 2.1.1 DESCRIPTION:

The onion is a truncated bulb, compressed or round, or oblong in figure, invested with a shining, thin, dry membrane, of reddish or white colour. It is less pungent to the taste than garlic, with some degree of sweetness, and a peculiar, well-known odour. Onion bulbs are of various shapes and sizes, usually globular, the layers being juicy (46).

#### 2.1.2 PLANT: (47)

**Botanical name:** *Allium cepa* L.

**Family:** Alliaceae

#### 2.1.3 Scientific classification (46)

Kingdom: Plantae

Division: Magnoliophytes

Class: Liliopsid

Order: Aspergillus

Family: Alliaceae

Genus: Allium

Species: A. cepa

Edible Parts: Flowers, Leaves, Root, Seed

#### 2.1.4 CHEMICAL CONSTITUENTS:

Analytical grade chemicals, methanol, sulphur, dichloromethane, trichloroacetic acid, acetic acid, acetonitrile, sodium hydroxide, Folin-Ciocalteu reagent, gallic acid, 2,2-diphenyl-1-picrylhydrazyl (DPPH), dinitrophenyl hydrazine (DNPH), quercetin, kaempferol, 2-octanol, sodium sulphate, and ferulic and chlorogenic acids (48).

#### 2.1.5 MEDICINAL USES (49)

1. Consumption of half a raw onion per day is beneficial in controlling cholesterol levels, as raw onion encourages the production of good cholesterol (HDL), thus keeping your heart healthy.

2. A mixture of onion juice and honey can be used to cure common cold and flu. Onions contain a good amount of vitamin C and the phytochemicals in onions improve the working of vitamin C in the body, thus improving your immunity.

3. Eat one medium onion, raw or cooked per day is super beneficial for your overall health: If you want to thin the blood, lower cholesterol, cure asthma, fight hay fever, treat infections, then eat onions!

The quercetin in onion helps you great in these ways, and it is even linked to inhibiting human stomach cancer. Till now, there is no better food source of quercetin than onion skins.

4. Onions have anti-bacterial property, chop up a raw onion and cover it with manuka honey, leave it for five hours. It makes a great cough syrup and is soothing for an inflamed throat effectively.

5. Onion juice can cure an insect bite or a bee bite, apply onion juice on the area for an immediate relief from the pain.

6. Onion juice mixed with mustard oil or sesame oil when applied externally helps relieving the arthritis pain.

7. Headache: Apply crushed onion on the forehead and temples to get a relief.

8. Mix 1 tablespoon of honey, 1/8 tablespoon of black pepper in a cup of onion juice and ginger juice mixture. This drink works as an effective natural treatment for asthma.

9. Onion juice is also used to cure ear and eye problems. Put 2-3 drops of warm onion juice in ears helps reduce earache. And make your own eye drop by adding onion juice in sufficient rose water to cure painful eyes and improve vision.

10. Onions are bactericidal, so you can chew onion to treat the toothache. Cut a piece of raw onion and chew it with the effected tooth for some minutes.



### 2.1.6 USES OF ONION FOR HAIR CARE (50)

#### KEEPS HAIR LOSS AWAY

Onions are rich in antioxidants and hence help in strengthening the hair roots and follicles and secure a healthy growth of hair cells. Regular use of onion juice on the hair facilitates formation of keratin for hair that aids in their regrowth. Thus, onion juice for hair growth as well as stoppage of hair fall is one of its main benefits.

#### RICH IN SULFUR

Onions belong to the Alliaceae family and so are loaded with sulphur. It is also a good source of phytonutrients that are required to make the strands strong and thick. Sulphur provides a lot of nourishment keeping the hair texture also smooth and silky. Its presence in the scalp and hair also ensures minimal thinning and breakage of hair.

#### NOURISHES SCALP

Onions for hair benefits also include providing nourishing the hair follicles and encourage growth of silky soft and naturally shiny hair. It's regular use on the strands can help restore the lost nutrients to the scalp and increase blood circulation. Thus, giving you problem free and manageable hair.

#### REDUCES PREMATURE GREYING

Premature greying of hair is what most of us suffer from. Using onion juice for hair is one of the best benefits of onion juice for hair it also maintains a soft and silky hair texture.

#### FIGHTS DANDRUFF

Since onions are anti-bacterial and anti-fungal in nature, they keep the scalp fresh and clean and helps to remove dandruff and fight infections as well. As they are pungent, onions also make the hair and scalp inhabitable for lice.

#### ADDS VOLUME

Onion benefits for hair include adding bounce and volume to the otherwise dull and dry hair. Regular use of onion juice or paste can increase hair volume tremendously.

## 2.2 ALOE VERA

### 2.2.1 DESCRIPTION:

Aloe vera plant is used for its health, beauty, medicinal and skin care properties. The name Aloe vera derives from the Arabic word "Alloeh" meaning "shining bitter substance," while "vera" in Latin means "true" (51).

### 2.2.2 PLANT: (51)

**Botanical name:** *Aloe barbadensis* Miller

**Family:** Asphodelaceae (Liliaceae)

### 2.2.3 CULTIVATION: (51)

It grows mainly in the dry regions of Africa, Asia, Europe and America. In India, it is found in Rajasthan, Andhra Pradesh, Gujarat, Maharashtra and Tamil Nadu.

### 2.2.4 ANATOMY: (52)

The plant has triangular, fleshy leaves with serrated edges, yellow tubular flowers and fruits that contain numerous seeds. Each leaf is composed of three layers:

- 1) An inner clear gel that contains 99% water and rest is made of glucomannans, amino acids, lipids, sterols and vitamins.
- 2) The middle layer of latex which is the bitter yellow sap and contains anthraquinones and glycosides.
- 3) The outer thick layer of 15–20 cells called as rind which has protective function and synthesizes carbohydrates and proteins. Inside the rind are vascular bundles responsible for transportation of substances such as water (xylem) and starch (phloem).

### 2.2.5 CHEMICAL CONSTITUENTS:

Active constituents with its properties: Aloe vera contains 75 potentially active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids (51) (53) (54) (55) (56).



**Vitamins:** It contains vitamins A (beta-carotene), C and E, which are antioxidants. It also contains vitamin B12, folic acid, and choline. Antioxidant neutralizes free radicals.

**Enzymes:** It contains 8 enzymes: aliase, alkaline phosphatase, amylase, brady kinase, carboxypeptidase, catalase, cellulase, lipase, and peroxidase. Brady kinase helps to reduce excessive inflammation when applied to the skin topically, while others help in the breakdown of sugars and fats.

**Minerals:** It provides calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium and zinc. They are essential for the proper functioning of various enzyme systems in different metabolic pathways and few are antioxidants.

**Sugars:** It provides monosaccharides (glucose and fructose) and polysaccharides: (glucomannans/ polymannose). These are derived from the mucilage layer of the plant and are known as mucopolysaccharides. The most prominent monosaccharide is mannose-6-phosphate, and the most common polysaccharides are called glucomannans [beta-(1,4)-acetylated mannan]. Acemannan, a prominent glucomannan has also been found. Recently, a glycoprotein with antiallergic properties, called alprogen and novel anti-inflammatory compound, C-glucosyl chromone, has been isolated from Aloe vera gel (55) (56).

**Anthraquinones:** It provides 12 anthraquinones, which are phenolic compounds traditionally known as laxatives. Aloin and emodin act as analgesics, antibacterial and antiviral.

**Fatty acids:** It provides 4 plant steroids; cholesterol, campesterol,  $\beta$ -sisosterol and lupeol. All these have anti-inflammatory action and lupeol also possesses antiseptic and analgesic properties.

**Hormones:** Auxins and gibberellins that help in wound healing and have anti-inflammatory action.

**Others:** It provides 20 of the 22-human required amino acids and 7 of the 8 essential amino acids. It also contains salicylic acid that possesses anti-inflammatory and antibacterial properties. Lignin, an inert substance, when included in topical preparations, enhances penetrative effect of the other ingredients into the skin. Saponins that are the soapy substances form about 3% of the gel and have cleansing and antiseptic properties.

#### 2.2.6 MECHANISM OF ACTION:

**Healing properties:** Glucomannan, a mannose-rich polysaccharide, and gibberellin, a growth hormone, interact with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation, which in turn significantly increases collagen synthesis after topical and oral Aloe vera (57). Aloe vera gel not only increases collagen content of the wound but also changes collagen composition (more type III) and increases the degree of collagen cross linking. Due to this, it accelerates wound contraction and increases the breaking strength of resulting scar tissue (58). An increased synthesis of hyaluronic acid and dermatan sulphate in the granulation tissue of a healing wound following oral or topical treatment has been reported (59).

**Effects on skin exposure to UV and gamma radiation:** Aloe vera gel has been reported to have a protective effect against radiation damage to the skin (60) (61). Exact role is not known, but following the administration of aloe vera gel, an antioxidant protein, metallothionein, is generated in the skin, which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin. It reduces the production and release of skin keratinocyte-derived immunosuppressive cytokines such as interleukin-10 (IL-10) and hence prevents UV-induced suppression of delayed type hypersensitivity (62).

**Anti-inflammatory action:** Aloe vera inhibits the cyclooxygenase pathway and reduces prostaglandin E2 production from arachidonic acid. Recently, the novel anti-inflammatory compound called C-glucosyl chromone was isolated from gel extracts (56).

**Effects on the immune system:** Alprogen inhibit calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells (55). In a study on mice that had previously been implanted with murine sarcoma cells, acemannan stimulated the synthesis and release of interleukin-1 (IL-1) and tumour necrosis factor from macrophages in mice, which in turn initiated an immune attack that resulted in necrosis and regression of the cancerous cells (63). Several low-molecular-weight compounds are also capable of inhibiting the release of reactive oxygen free radicals from activated human neutrophils (64).

**Laxative effects:** Anthraquinones present in latex are a potent laxative. It increases intestinal water content, stimulates mucus secretion and increases intestinal peristalsis (65).

**Antiviral and antitumor activity:** These actions may be due to indirect or direct effects. Indirect effect is due to stimulation of the immune system and direct effect is due to anthraquinones. The anthraquinone aloin inactivates various enveloped viruses such as *herpes simplex*, *varicella zoster* and influenza (66). In recent studies, a polysaccharide fraction has shown to inhibit the binding of benzopyrene to primary rat hepatocytes, thereby preventing the formation of potentially cancer-initiating benzopyrene-DNA adducts. An induction of glutathione S-transferase and an inhibition of the tumour-promoting effects of phorbol myristic acetate has also been reported which suggests a possible benefit of using aloe gel in cancer chemoprevention (67) (68).

**Moisturizing and anti-aging effect:** Mucopolysaccharides help in binding moisture into the skin. Aloe stimulates fibroblast which produces the collagen and elastin fibres making the skin more elastic and less wrinkled. It also has cohesive effects on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acids also soften hardened skin

cells and zinc acts as an astringent to tighten pores. Its moisturizing effects has also been studied in treatment of dry skin associated with occupational exposure where aloe vera gel gloves improved the skin integrity, decreases appearance of fine wrinkle and decreases erythema (69). It also has anti-acne effect.

**Antiseptic effect:** Aloe vera contains 6 antiseptic agents: lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulphur. They all have inhibitory action on fungi, bacteria and viruses (51).

### 2.2.7 USES (70) :

- In heartburn relief
- Keeping produce fresh
- An alternative to mouthwash
- Lowers blood sugar
- A natural laxative
- In skin care
- It has the potential to fight breast cancer

## III. DISCUSSION

From the above information we came to know that the hair growth cycle is divided into three phases viz. anagen, catagen and telogen. Telogen is the stage in which most of the hair strands are present. Hair dyes, especially permanent one's act by oxidation process. Oxidizing agent like hydrogen peroxide and alkalizing agent like ammonia opens up the cuticle and allows the penetration of hair dye. However, this results in the weakening of hair and also ammonia can cause skin burns, skin irritation and eye burn. Albeit these days, no ammonia dyes are available, but the chemicals in it ultimately keep degrading the quality of hair.

We have seen that Onion and Aloe vera, both have the various constituents that are beneficial for hair, not only in maintaining the quality, but also increasing the rate of growth or even cause regrowth of hair.

For example, Onions are rich in sulphur which repairs the disulphide bonds in follicles that were lost during the dyeing process, and also it is the part of keratin which is known for providing the strength to the hair shaft. Apart from this, it has antioxidants (flavonoids like quercetin) which helps to scavenger free radicals and also improves the blood circulation ultimately benefiting the hair growth.

On the other hand, use of Aloe vera for hair health is due to its plentiful supply of vitamins, minerals, and other ingredients linked to hair growth. These properties are signs of its ability to promote healthy and abundant hair.

Aloe vera has various constituents like vitamins, enzymes, anthraquinones, hormones, fatty acids, etc., which help in repair of dead skin cells in scalp, condition the hairs leaving them smooth and shiny.

Both, Onion and Aloe vera have anti-inflammatory and anti-allergic properties due to which they can help in various skin allergies caused due to dyeing of hair. Aloe vera also has antiseptic activity.

## IV. CONCLUSION

The harmful effects of hair dye are well known and needs due care for hair during the colouring or dyeing process. The advantages of Onion and Aloe vera can be seen due to the inherent properties in these two. The protective effect of onion is well elaborated because of its richness in sulphur which in turn repair the disulphide bonds in follicles and richness in flavonoids, which help in antioxidant free radical scavenging activity. Nowadays various hair formulations are marketed as onion as one of the main ingredients.

Due to the protective effect of onion on hair, it is used in various other hair formulations to counteract the damaging effect, it also has the nutritive effect on hair. Because of the exceptional properties in Onion and Aloe vera these can be used in the hair dye formulation, too. There is a need for further research in this area for combining it with the hair dye formulations.

## V. IMPORTANT SENTENCES

- The main constituents of hair are of  $\alpha$ -keratin, a group of proteins which account for 65% - 95% of hair weight.
- Permanent hair dyes are called oxidation hair dyes, because of the oxidizing agent used for the colour development.
- Hair colouring involves the use of chemicals capable of removing, replacing, and/ or covering up pigments naturally found inside the hair shaft.
- In vitro and in vivo studies conducted by International Agency for Research on Cancer (IARC) (in exposed human populations) have shown that some hair dyes and chemicals used in the hair dyeing process can be considered mutagenic & carcinogenic.
- Regular use of onion juice on the hair facilitates formation of keratin for hair that aids in their regrowth. Thus, onion juice for hair growth as well as stoppage of hair fall is one of its main benefits.

- Aloe vera has various constituents like vitamins, enzymes, anthraquinones, hormones, fatty acids, etc., which help in repair of dead skin cells in scalp, condition the hair leaving them smooth and shiny.
- Both, onion and aloe vera have anti-inflammatory and anti-allergic properties due to which they can help in various skin allergies caused due to hair dyeing.

## VI. DECLARATION OF INTEREST

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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