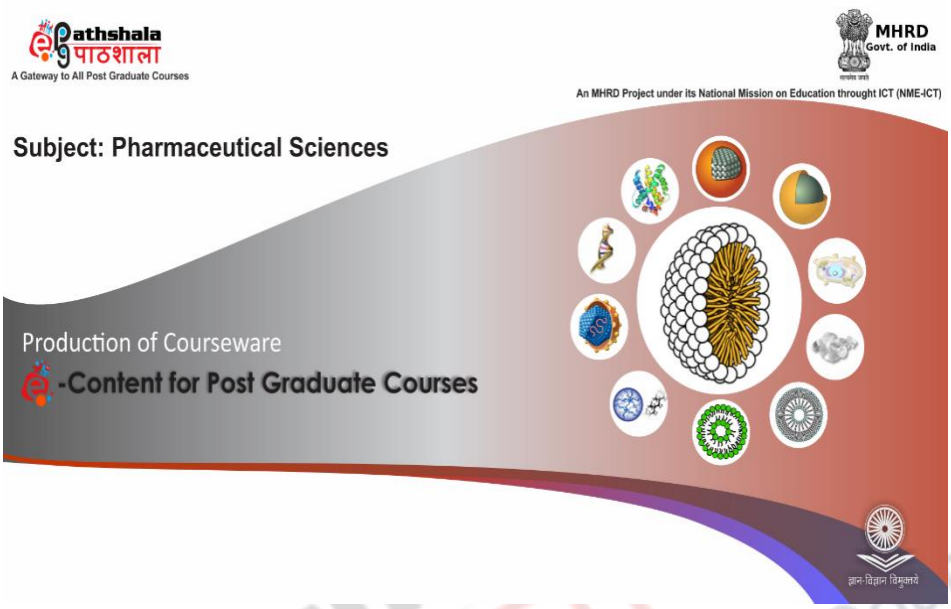

Development Team

Principal Investigator	Prof. Farhan J Ahmad Jamia Hamdard, New Delhi
Paper Coordinator	Dr. Javed Ali Jamia Hamdard, New Delhi
Content Writer	Mohammad Kashif Iqubal Jamia Hamdard, New Delhi
Content Reviewer	Dr. Mohd. Aqil Jamia Hamdard, New Delhi

CONTENTS

HAIR REMOVAL PRODUCTS

1. INTRODUCTION

Hair removal is an increasingly important sector of the cosmetic and personal care industry. Both men and women are becoming more concerned about the aesthetic aspect of their appearance. Human beings choose to remove unwanted body hair for acosmetic, social, cultural, or medical reason.A number of hair removal techniques have been developed over the years, including methods for temporary and permanent hair removal. The availability of the current methods and products may be different; most of them can be used at home; however, there are some that can be used only in professional salons and dermatological offices.

2. METHODS FOR REMOVING HAIR

Now a day, there are a number of hair removal techniques and products available. Temporary methods provide hairless skin for a shorter (1–3 days) or a longer time (1–3 weeks), depending on the technique and the individual's physiological characteristics. Permanent methods, however, can prolong the duration of hair loss up to years. The techniques outlined and shaded refer to those that include the use of cosmetic products. There are two distinct types of temporary hair removal, known as depilation and epilation.

2.1. Depilatory techniques

Depilatory techniques and products remove only part of the hair shaft, which protrudes above the skin surface. These techniques are generally pain-free if there is no skin damage. Depilatory techniques include shaving, trimming, using abrasives, using chemical depilatories, and bleaching.

- Shaving is a frequently used method since it is fast, easy, painless, effective, and relatively inexpensive. It requires a shaving tool, i.e., razor.
- Trimming is performed using scissors developed for this purpose. This method can be used to trim long eyebrow hair.

- Abrasives, such as pumice stones or gloves made of fine sandpaper, work by physically removing the hair from the skin's surface. This method is very irritating and is rarely used today for hair removal.
- Chemical depilatories dissolve hair fibers causing the hair to break, which can be easily washed away from the skin. Products available include gels, creams, lotions, and aerosols.
- Bleaching is often referred to as a hair removal technique; however, it does not remove any part of the hair shaft but changes its color.

2.2. Epilatory techniques

Epilatory techniques and products remove the entire hair shaft with its root in the dermis. These techniques are more effective and have a longer effect since it takes a longer time for the hair shaft to completely regrow than just regrowing from under the skin as in the case of shaving. Epilation techniques include using epilators, tweezing, waxing and sugaring, and threading and using medications.

- Tweezing, or otherwise known as plucking, is best performed using tweezers. It is a beneficial method for removing a small group of hairs found on the eyebrows, for example. This method can be used for small surfaces that are not readily accessible to epilators. However, it is a time-consuming and tedious method.
- Waxing involves applying warm or cold wax onto the hairy skin and quickly stripping off the wax and hairs against the direction of hair growth. It is the most effective epilation method since hair is removed in large quantities from a large surface area. Sugaring is similar to waxing, but instead of a wax, a mixture of sugar, lemon juice, and water is used to formsyrup.
- Threading is an ancient manual technique that involves the use of a long twisted loop of thread rotated rapidly across the skin. Hairs are trapped within the tight entwined coils and are pulled off. This technique is very popular in many Arabic countries.
- Epilator is an electrical device that removes hair by mechanically grasping them and pulling them out.

- Eflornithine, a novel method for temporary hair reduction in women, is a topical cream available by prescription only and has been approved by the FDA for the reduction of unwanted facial hair in women. It is not a hair removal or depilatory product but a topical cream that decreases the rate of hair growth.

2.3. Permanent hair removal

- Laser treatment stops the active growth of the hair for long periods. Its principle is based on the fact that there is a difference in color between the hair follicle and the skin. The light energy absorbed by the dark pigment in the hair follicle (i.e., melanin) causes damage to the follicle, thereby reducing hair growth. The lighter the skin and the darker the hair, the more selectively the laser will affect the follicle and not the surrounding tissue. A laser instrument produces a powerful, focused light beam, composed of a constant wavelength.
- Intensely pulsed light devices also use the principle of thermal destruction (i.e., photothermolysis), similar to lasers, to target the melanin in the hair follicle. However, here a range of wavelengths is used, typically between 500 and 1200 nm, instead of one wavelength.
- Electrolysis, also termed electrology, involves the insertion of a small, fine needle into the hair follicle, followed by thefiring of a pulse of electric current that damage and eventually destroys the hair follicle. As a result, hair breaks off at the root and can then be easily pulled off with fine tweezers. It is effective, especially in small areas.

3. REQUIRED QUALITIES/ CHARACTERISTICS OF HAIR REMOVAL PRODUCTS

A quality hair removal product should possess the following characteristics:

- Good lubricant properties for skin protection against razor
- Hydrating properties to soften the skin and hair
- Well-tolerated, non-irritating with pleasant odor
- Easy application with a tendency to spread easily
- Easy removal from the razor and skin

- Creaminess
- Relatively pain-free
- Pre-treatment products: make hair removal easier and remove oil and sweat from the skin
- After-treatment products: hydrate and cool the skin, alleviate pain and redness and prevent infections
- Long-term stability with appropriate texture
- Foaming products: appropriate foam structure, foam density, foam viscosity, and foam stability
- No leakage from aerosol cans
- Appropriate pH
- Dermatological safety.

4. TYPES OF HAIR REMOVAL PRODUCTS WITH TYPICAL INGREDIENTS

4.1. Pre-treatment products

Pretreatment products may have various functions depending on the type of hair removal technique used. They are designed to make hair removal easier and more comfortable and reduce the potential for skin irritation. The aim of pre-treatment can also be to achieve moisture reduction on the skin using powders, which can also enhance the effectiveness of the waxes. They are more often used for soft waxes.

- Cleansing products can be used to remove dirt, makeup, sweat, and other chemicals from the skin. They may include antiseptic and astringent compounds, such as witch hazel or alcohol, to reduce the chance of infections.
- Prewax treatment products, for example, oils and lotions, help hard wax to stick only to the hair shaft but not to the skin. It is also helpful if the patient has very dry skin. However, applying too much of such products can prevent the wax from sticking to the hair. Prewax products primarily contain emollients and botanical extracts, such as soy oil, tea tree oil,

grape-seed oil, and aloe vera extract, which may have added calming and soothing properties.

- Similar to oils, overuse of powders can decrease the adhesive power of waxes to the hair.
- Creams are also available on the market, which is intended to be used before waxing. These products contain local anesthetics, such as benzocaine, tetracaine, and lidocaine, which can reversibly block nerve conduction near the site of administration, thereby producing atemporary loss of sensation in a limited area.

4.2. Depilatories

The term "depilatory" has been applied to any preparation designed for the removal of superfluous hair (in particular hair occurring on the face and legs, as well as in the axilla) without causing injury to the skin, a distinction must be drawn between the mechanical removal of hair either by plucking it with tweezers or by embedding it in an adherent material that can then be pulled away from the skin, bringing the hair with it (a process referred to as epilation), destruction of hair papillae by electrolysis, and the removal of hair after it has been sufficiently degraded by chemical means.

4.2.1. Chemical depilatories

Today the term depilatory as used to a preparation intended for the chemical breakdown of superfluous hair without injury to the skin. The advantage of such preparations is that they preempt any danger of cutting or abrading the skin in regions such as the underarms, where it is difficult to see the area clearly and even more difficult to guide a razor over the complicated contours. There is also a widespread belief that shaving increases the rate of hair growth or the coarseness of the hair. Although these beliefs are unfounded in fact, chemical depilatories have the apparent advantage that they discourage the regrowth of hair if they are applied regularly. There seems to be no scientific explanation for this, but possibly it arises from a gradual removal of keratinous debris from the mouth of the hair follicle, which allows removal of the hair at a deeper level.

Provided that the skin is reasonably healthy, the time of application of the depilatory is not too long, and depilate is correctly formulated, very little if any skin damage will result. In formulating depilatory preparations, therefore, care should be taken to ensure that they will react with the hair preferentially and that their effects will be sufficiently rapid to cause disintegration of the hair before they cause any damage to the underlying and surrounding skin.

In line with the requirement for a rapid depilation, depilatory preparations usually contain as their active component a strongly alkaline reducing agent. The latter causes the hair fibers to swell and produces cleavage of the cystine bridges between adjacent polypeptide chains as a preliminary to the complete degradation of the hair.There are few examples of chemical used as adepilatory.

Sulfides:

The use of sulfides has been known, for a very long time; patents covering the use of barium polysulfide for removing hair are more than 100 years old. Compositions based on thealkali and alkaline earth sulfides are capable of producing rapid depilation, particularly if used together with a suspension of lime. The alkali sulfides such as sodium sulfide were, however, found to be too drastic in action. Their depilatory action is linked to their hydrolysis and the formation of sulphydrates and sodium hydroxide. The latter acts as a primary irritant and will produce erythema. Even a dilute (2%) aqueous solution of sodium sulfide will have a pH of 12. Although it will disintegrate hair within 6-7 minutes, it may simultaneously damage the stratum corneum. It is, therefore, no longer used in marketed depilatory preparations.

Strontium sulfide is a much milder depilatory but must be used at a higher concentration than sodium sulfide to produce an equivalent dehairing action. Preparations containing strontium sulfide, although largely replaced today by those based on thioglycolatesare still available. They are very effective and work within 3-5 minutes after application.

In addition to the active agent, a depilatory preparation may contain a humectant such as glycerin or sorbitol. A thickening agent (e.g., methylcellulose) may sometimes be incorporated, so as to

thicken the solution sufficiently to allow it to remain in contact with the hair as long as necessary.

Despite their disadvantages, sulfide-based depilatories are preferred by many African American men for removing facial hair because of their comparatively rapid action.

Stannites

In the 1930s considerable attention was devoted to the use of "soluble stannites." Several patents describe sodium stannite solutions as depilatories. Despite their acceptable low odor, they have been largely abandoned because of their instability, forming stannates in the presence of water. Nevertheless, the recommended stabilizers were not found to be effective and did not produce stable preparations.

Substituted Mercaptans

The majority of depilatories available today are based on substituted mercaptans, which are used in the presence of alkaline-reacting materials (e.g., calcium thioglycolate) in conjunction with calcium hydroxide. These preparations possess fewer odors than the sulfide type but take longer to act. They are safer on the skin than sulfides and can, therefore, be used on the face—an area where superfluous hair can cause great distress and where women have a strong psychological aversion to using a razor. In general, thioglycolate preparations are more attractive than the sulfide types. However, their slowness in attacking the coarse and resistant hair of the underarm has left a market open for sulfide depilatories for this specific purpose. It is often said that depilatories can be used for smoothing the legs, but the amount required to cover the leg makes it uneconomical for most users.

Thioglycolates

Thioglycolate-based preparations are nontoxic and stable at use concentrations, that is, between 2.5% and 4%. At common use concentrations (about 4%), they may produce depilation in 5-15 minutes, this again depending on the pH of the preparation. This should not be less than pH 10

and should preferably be about pH 12.5 to produce depilation within a fairly short time and without irritating the skin.

Other "Thio" Compounds

Thioglycolic acid is the most economical and effective active agent of this type. However, legal limitations on the home use of thioglycolates resulted in the introduction of products in which thiolactic acid, 3-mercaptopropionic acid, or thioglycerol replace thioglycolate.

Enzymes

Nonirritating and odorless depilatory preparations based on the enzyme keratinase have also been developed. A keratinase, isolated from *Streptomyces fradiae,* was found to be capable of digesting keratin (U.S. Pat. 2,988,488). The extremely slow depilatory action interfered with the commercial success of these preparations.

4.2.2. Facial depilatories for African-American skin

Curly and wiry hair is found on theface of theblack male. After shavingthe exposed ends of the hairs with sharp points is left, and as the hairs regrow these sharp points can actually turn back onto and penetrate the skin, causing a clinical condition called *Pseudofolliculitis barbae*. To overcome this problem they prefer to use a depilatory that gives a closer shave and it also provides the softness at hair tip and blunt that's why it does not puncture and reenter the skin.

Traditional thioglycolate-based depilatories take 15-20 minutes to remove beard hair, which takesa long time to show their action.Powder depilatory is also a better option, and it is to use a powder depilatory that must be mixed with water before use but theyprovides adequate hair removal in 3-7 minutes. Commonly used active ingredient in in the United States as powder depilatories is calcium thioglycolate that exhibits low odor and is easily perfumed.

4.3. Epilatories

Epilation has some following because the effect may be slightly longer lasting since the epilated hairs also remove the hair bulbs or the hair papillae. This may create a relatively long pause before the hair starts growing in the follicle and reaches the surface of the skin. It is, however, not painless and can often cause serious skin damage and subsequent infection and is therefore frowned upon by physicians.

There has been no dramatic development of a "painless" epilatory in the industry. The few and limited developments have been concerned with modifications in the method of application, such as the provision of a flexible backing strip, and the provision of a preparation that does not require melting prior to use but can be applied cold, the preparation being based on a mixture of glucose and zinc oxide or a honey, sugar, and citric acid mixture. The use of a "rubber solution," in which the solvent evaporates and the rubber film is stripped off, is covered in a U.S. patent.

4.3.1. Waxes Waxing is an epilation method that involves applying warm or cold wax onto hair-bearing skin and quickly stripping off the hardened wax and embedded hairs. There are two types of waxes that are widely used to remove unwanted hair: cold or hot soft strip wax and hot hard stripless wax. All these products need some sort of training for proper use.

- Hot soft wax has more of a liquid consistency on theapplication. As it is applied to the skin in a hot form, it more readily runs to the base of the hair shaft. It spreads as a thin film and is removed with a nonwoven or muslin strip. It is applied in the same direction as the hair grows and is removed in the opposite direction.
- Cold strip waxes work similar to hot soft waxes. Strips precoated with wax or a cool, sugar-based substance are pressed onto the skin in the direction of the hair growth and pulled off in the opposite direction.
- In hot hard waxing, a thicker layer of heated wax is applied to the skin. The hair becomes embedded in the wax as it cools and hardens. It is usually much thicker and sets much

faster; generally, it is recommended for stronger hair on smaller areas. The wax is pulled off quickly by hand, taking the uprooted hair with it.

The consistency of wax products varies as do their melting points. The melting point of a wax must be greater than the body temperature in order to solidify on the skin. However, its melting point should be low enough to spread over the skin without burning it. In addition, the wax must be sufficiently firm to grip the hair. A proper working temperature for hard wax is between 125 and 140 ^{0}F for application.

As none of the simple waxes used, for example, meets these criteria, hair removal waxes are based on rosins, often combined with simple waxes, such as beeswax, to modify their melting point and increase their strength.

The main ingredients of waxes are as follows:

- Hair-binding agents provide stickiness and enable the wax to "catch" the hair follicles. Rosin is the one of the examples of hair binding agent. Rosins are hard and translucent components, derived from pine trees. Such as wood rosin, gum rosin, dimerized rosin, and esters of rosins. Another example is rosinates, these are glyceryl monoesters made of glycerin and rosins. They contribute to the adhesion of waxes. Such as methyl hydrogenated rosinate, glyceryl hydrogenated rosinate, polyethylene glycol hydrogenated rosinate, and triethylene glycol rosinate.
- Skin conditioning and skin protective agents protect the skin from damage during the waxing process as well as modify the melting point of the rosins and rosinates and make them more flexible. There are few Examples of waxes occurred, such as beeswax, candelilla wax, and carnauba wax; oils, such as mineral oil, almond oil, linseed oil, soybean oil, and safflower oil; butter, such as cocoa butter and shea butter; and silicone oils. Natural components are also used they may have additional benefits, such as an anti-inflammatory effect. For examples include honey extract, *calendula officinalis* flower extract, and aloe extract.

- Additional ingredients can include preservatives, such as phenoxyethanol, benzoates, and parabens and antioxidants, such as butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA); if water is used in the formulation, water-soluble thickeners may also be added to provide an optimal texture for the formulations. Furthermore, colorants, such as iron oxide, alumina hydroxide, titanium dioxide, and organic pigments and fragrances can also be incorporated into the formulations.

4.4. Sugaring

Sugaring is a hair removal method same as to waxing. The sugar mixture is prepared by heating sugar, lemon juice, and water to formsyrup. Examples for sugar components include corn syrup, honey extract, and maltodextrin. The syrup is formed into a ball, flattened onto the skin, and then quickly stripped away. Same as waxing, the hair is removed entirely from the hair shaft, and sugaring is another choice for waxing for people sensitive to wax. Sugar-based hair removal products may be applied with the hand or with a spatula. Neither method carries the risk of burning the skin since they are used at room temperature. In addition, the original formulas without resins do not adhere tightly to the skin. Today, manufacturers sometimes incorporate resins in the formulas, making them similar to waxes with the disadvantages of waxes.

The main disadvantage of this technique is that sugar and sugar derivative–based compositions contain substantial amounts of water or alcohol, or mixtures of water and alcohol, which tend to evaporate each time the bottle is opened for product application. This results in the crystallization of sugar or sugar derivatives from such compositions, which causes a loss of hair removing thepower of the product. It also makes it more difficult to open the bottle before use.

4.5. Electrolysis

The mechanical waxing methods mentioned earlier are temporary and not often only fully effective since the papillae are not always removed and hair soon reappears. The most effective method of hair removal is undoubtedly electrolysis, which entails inserting a needle into the hair follicle and completely destroying the hair root by means of a weak DC current. This method is

practiced in beauty salons and by some dermatologists but is expensive and time-consuming since every hair must be treated individually, and even a competent operator can only deal with 25-100 hairs per sitting.

5. FORMULATIONS

A general formula and formulation for depilatory cream are represented in table 1.

Table 1: Depilatory Cream.

Ingredient	%
Coconut alcohol	6.5
Calcium thioglycolate	5.4
Calcium hydroxide	7.0
Sodium lauryl sulfate	0.02
Sodium silicate	3.43
Perfume	q.s.
Water	to 100

The preparation of depilatory Cream involves the following distinct steps:

1. Heat the water to 70 °C.
2. With stirring add the lauryl sulfate and fatty alcohol; continue stirring until melted and dispersed.
3. Discontinue heating and cool, stirring until room temperature.
4. Add the calcium hydroxide and perfume.
5. Add the calcium thioglycolate and stir until uniform.

A general formula and formulation for semifluid depilatoriesare represented in table 2.

Table 2: Semifluid Depilatories.

Ingredient	%
Cream base	
Water	60.0
Cetyl alcohol	6.0
Laureth-23	1.0
Final product	
Water	17.3
Calcium thioglycolate	5.4
Calcium hydroxide	6.6
Strontium hydroxide	3.7
Perfume	q.s.
Cream base (as above)	67.0

The preparation of semifluid depilatories involves the following distinct steps:

1. Prepare the cream base at 70 °C and allow to cool at room temperature.
2. Add the calcium thioglycolate to the bulk of the water and mix well; add the calcium hydroxide slowly with stirring, followed by the strontium hydroxide and any remaining water.
3. Combine the two parts and stir well, adding the perfume at this point.

A general formula and formulation for semifluid depilatories are represented in table 3.

Table 3: Powder Depilatory.

Ingredient	%
Calcium thioglycolate	20.0
Calcium hydroxide	23.1
Strontium hydroxide	8.9
Sodium lauryl sulfate (powder)	1.5
Hydroxyethylcellulose	1.0
Magnesium carbonate	45.2
Perfume	0.3

The preparation of depilatory powder involves the following distinct steps:

1. Mix the calcium thioglycolate, calcium hydroxide, strontium hydroxide, sodium lauryl sulfate, and hydroxyethylcellulose.
2. Blend the perfume thoroughly with the magnesium carbonate.
3. Add the latter to the former and blend thoroughly.

For a sulfide depilatory, the following formula will be found effective:

Table 4: Sulfide Depilatory.

Ingredient	%
Strontium sulfide	20.0
Talc	20.0
Methylcellulose	3.0
Glycerin	15.0
Water	42.0

A similar composition may be prepared using an emulsion base for smoothness and stability.

For many years epilatory preparations were based on mixtures consisting essentially of rosin and beeswax, modified in some instances by the addition of mineral oil and/or waxes.

Table 5: Epilating Wax.

Ingredient	%
Rosin	75.0
Beeswax	25.0

In addition to rosin and waxes, mineral or vegetable oil may be included (for example, at a level of about 15%). Camphor is often included for its cooling effect which reduces the discomfort experienced when the hair is pulled off. A local anaesthetic, for example, benzocaine or butyl PABA, can enhance this effect, and an antibacterial compound will reduce the chance of infecting the skin after damage or exposure.

Table 6: Epilating Wax.

Ingredient	%
Rosin	52.0
Beeswax	25.0
Paraffin	17.0
Petrolatum	5.0
Perfume	1.0

The preparation of epilation wax involves the following distinct steps:

1. Melt the rosin and waxes, mix, and add the petrolatum; when the temperature drops to about 60 °C, add the perfume and pour the melted mass into suitable molds.
2. When this wax is used it is melted and painted over the surface to be dehaired.

6. EFFECTS OF HAIR REMOVAL PRODUCTS ON THE SKIN AND HAIR

Removing unwanted hair has become a part of many people's everyday life. Villus hair turns into terminal hair during puberty, in the beard area, for example; this is one of the reasons why young men start shaving. In some cultures, the hairless face is recognized as more hygienic. Sometimes, hair removal may be mandatory, such as a tradition when reaching a certain age, or on the contrary, it may be forbidden in other cultures for religious reasons. Very frequent and/or inappropriate hair removal can lead to adverse effects and skin reactions. The common side effects of various hair removal techniques are summarized as follows:

- Alcohols found in many pretreatment products and aftershave preparations have an **antibacterial effect** and provide a **cooling sensation** to the skin. It may, however, dry out the skin and lead to a burning sensation when used on freshly shaved skin.
- When using a razor, blades may **cut** the skin, leading to bleeding. If not treated appropriately, infections and inflammation may occur at these skin sites. If the skin is cut severely, it may cause permanent scarring as well.
- Hair removal may lead to temporary **pain, itching, and/or swelling** of the treated area, skin sensitivity, and skin irritation. It is hypothesized that the discomfort associated with shaving is a result of localized skin displacement and/or the rotation and extension of the

beard fiber in its follicle. Shaving can remove irregular skin elevations, which may also lead to irritation. The sensory nerves located in the dermis all around the hair follicles' root will transmit a pain signal to the brain. This is why epilation methods are painful. However, the pain is temporary and usually resolves by itself.

- Certain aftershave formulations contain fragrances, which can be **irritating** and lead to contact allergy.
- One of the most common complaints in shaving is **folliculitis**, i.e., inflammation of the hair follicles. Folliculitis starts when the hair follicles are damaged by shaving, for example, or affected by a condition called *Pseudofolliculitis barbae*. Most often, the damaged follicles become infected with *Staphylococcus* bacteria. This condition is often referred to as barber's itch, which occurs more frequently on the face, groin, and underarm than in the legs or arms. *Tinea barbae* is similar to barber's itch, but the infection is caused by a fungus.
- Another frequent problem that may occur after hair removal is the ingrown hair. An ingrown hair occurs when a shaved or tweezed hair grows back into the skin without entering the skin surface. The result of ingrown hairs is localized pain, irritation, and the appearance of bumps in the hair removal area. In most cases, it can get inflamed as well. It may be mild, which affects only a small number of hair follicles. However, when large areas are affected every time, the users should visit a dermatologist and see if other options are available.
- Wax is designed to adhere to the hair as close to the skin as possible. When the wax is removed, it should adhere to the hair and remove the hair from the follicle. If the wax is not applied appropriately, or if applied at the wrong temperature, or if the skin is not cleaned well, the hair will not be removed. If the wax is too hot, it can cause skin irritation and burn the skin causing blistering. Even surface layers of the skin can be removed along with the hair if waxing is not performed correctly.
- Chemical depilatories are highly alkaline products that can possibly damage and degrade the dermal proteins, causing skin irritation, excess exfoliation, or contact dermatitis if left on the skin for a longer period of time than recommended. Fortunately, this dermal effect is

usually temporary, lasting only a few hours or a day. The FDA warns consumers that they should read the product labels carefully and test the products on a smaller area before use. Evaluation of the test area should be done for 1 or 2 days. It is also recommended that consumers select the formulation appropriate for the intended use, as skin sensitivity varies throughout potential application areas.

- Certain medications may influence the healing capabilities of the skin; therefore, certain hair removal techniques should be avoided in patients taking such medications. An example is retinoids, which are frequently used in acne patients. Retinoids may cause permanent scarring in these patients; therefore, they should avoid using electrolysis, chemical depilatories, and waxing during acne treatment.
- As discussed earlier, there is no data available on the long-term effect of epilation, either temporary or permanent. It is hypothesized that repetitive epilation over several years may result in permanent damage to the hair follicles and production of finer or thinner hairs. However, long-term clinical trials demonstrating the effects of repetitive epilation are lacking.

7. AFTER DEPILATION/ EPILATION PREPARATIONS

Afterdepilation/ epilation preparations are intended to reduce redness and alleviate pain and burning sensation experienced after hair removal. In addition, they cool and refresh the skin and exert a mild astringent effect. They can also have anantibacterial activity to prevent infections while the skin recovers from the mild trauma caused by hair removal. They usually contain moisturizing ingredients to soothe and hydrate the skin. These products are also used to remove the remaining wax from the skin surface.

Preparations to be used after the application of chemical depilatories are generally available in the following dosage forms:

- The most popular types of products have been, and continue to be, clear solutions, also known as toners, containing about 40–50% of ethanol and an appropriate amount of water.

- Gels are also popular as they have a cooling effect resulting from the high water content.
- Lotions, also known as balms and creams also tend to be popular, especially among users with sensitive skin who experience irritation with alcoholic products. Balms are easy to apply and provide a soothing and moisturizing effect.

Afterwax preparations are mainly available as oils and wipes soaked into oily formulations. They may also contain antiseptics and anti-inflammatory ingredients to prevent infections and inflammation of the hair bulbs. After treatment products typically contain the following types of ingredients:

- Astringents contract the pores and help stop bleeding from minor cuts. For example ethanol; tea tree oil; boric acid; and aluminum and zinc salts, such as zinc sulfate, zinc chloride, and aluminum sulfate.
- Emollients and humectants soothe and moisturize the skin. There are few examples for emollients include olive oil, sweet almond oil, vitamin E, panthenol, decyl oleate or diisopropyl adipate, meadowfoam seed oil, and niacinamide, while those for humectants include glycerin, sorbitol, and propylene glycol.
- Cooling agents contribute to the refreshing effect of the formulations like menthol.
- Herbal extracts and essential oils usually have combined effects, including anti-inflammatory, antiseptic, healing, and soothing. Examples include aloe vera extract, orange peel oil, chamomile extract, calendula extract, lavender oil, and allantoin.
- Fragrances are usually also part of the formulations, which, however, may be irritating, especially for sensitive skin.
- Water is a basic part of solutions, gels, lotions, and creams.
- Other ingredients can include preservatives, emulsifiers in emulsion-based formulations, as well as coloring agents and thickeners.
- Afterwax products used to remove waxes from the skin mainly include oils, such as mineral oil, almond oil, and hexyldecyl stearate.

8. PACKAGING OF HAIR REMOVAL PRODUCTS

The most commonly used packaging materials for hair removal products include the following:

- Plastic Tubes and Jars: Hot stripless waxes are usually supplied in plastic jars that can be placed in a microwave to heat the products before use. Some manufacturers supply their products in jars that have a holder on one side. It allows one to handle the hot wax without burning. They may also supply wood spatulas to apply the product. Depilatory creams, pre-treatment gels, and after-treatment gels are packed into soft tubes (similar to toothpaste) or plastic jars. Some depilatory creams are supplied in plastic containers with a pump head. The package of chemical depilatories usually contains a plastic spatula for the removal of the product and the dissolved hair follicles.
- Wax Strips: Cold soft waxes are supplied in a ready-to-use form. Usually, muslin strips are coated with the wax that can be directly applied to the skin.
- Wax Containers with Roll-On Head: Hot soft waxes, which are removed with a piece of muslin strip, are usually supplied in plastic containers that have a roll-on head. This package makes their use, starting from heating to application to the skin, comfortable and easy.
- Glass and Plastic Bottles: Many pretreatment products and aftershave formulations are supplied in glass and plastic bottles.
- Aerosol Cans: Aerosol shaving foams are supplied in one-compartment cans, where the formulation and the propellant are mixed together. Aerosol shaving gels are filled into bicompartment cans, as discussed earlier.

9. EVALUATION OF HAIR REMOVAL EFFICACY

Tensile kinetics method

In this method, stress decay caused by disulfide bond reduction is measured, using commercial instruments such as a tensile strength tester, an optical diameter gauging system, and an

electrobalance. The time required to reduce the stress supported by thehair by 95% (T95%) was shown to correlate to in-vivo hair removal rate in commercial products.

HPLC method

This method can distinguish between thioglcerol, thiolacticacid and thioglycolic acid. The SH-group is coupled to &-Chloro-4-nitro benzo-2-oxo-1,3-diazole, which results in a yellow derivative permitting HPLC detection at 464 nm. The procedure is most suitable for use with aqueous preparations, including o/w creams and lotions.

Thermo-Mechanical method

In this method, a thermo-mechanical analyzer is used to measure the time at which a hair bundle, under constant stress and immersed in depilatory, begins to stretch. The analyzer is programmed to observe the stretching and/ or breaking of a hair fibre bundle, attached to a fibre tension probe necessary. The test is carried out under isothermal conditions and indicates good precisions, which can be correlated with results on animals.

pH determination

The pH of formulated lipsticks is determined using pH meter. A limit value for the maximum permitted pH value is 12.7.

Evaluation of depilatory efficacy

Along with above evaluation technique these two methods of evaluation of depilatory efficacy also available one of described by Yablonsky & Williams and thesecond one is by Elliot.

According to Yablonsky & Williams determining the efficacy of depilatories, it involves the measurement of the cross-sectional diameter and the length of a hair immersed in a solution of a depilatory and observing the time of maximum hair swelling. Sigmoidal curves are obtained when both the< length and the width of swelling hair are plotted against time. The slope maxima

of these sigmoidal curves may be used to define an index of depilatory effectiveness in vitro. No test results were given.

Elliot designed a depilometer to simulate practical use conditions as closely as possible. In-use tests gave good correlation, and rapid screening of formulation variables is possible using this technique. His depilation time represents the "time to break" of 10 fibers exposed to the depilatory at a load of 50 g. No adjustments were made for the mercaptide dissociation constant or for its molarity. A summary of his extensive data is difficult. He found considerable variation in depilating times between individuals, but in general, leg hair is easier to remove than axillary hair, which is similar to head hair. Some of Elliot's data are summarized in Tables 7 and 8.

Table 7: Efficacy of "Mercaptans" (5% Concentration at pH 11.0-12.0).

Mercaptan	Average depilation time*min)
2-Mercaptoethanol	4.0
Thioglycerol	6.5
Thioglycolic acid	7.5
3-Mercaptopropionic acid	8.0
2-Thiolactic acid	11.0
Thiodiglycol	15.0
Thiomalic acid	15.0

*Average of times for various alkalis used for neutralization

Table 8: Relative Efficacy of Various Alkalis.

Hydroxide	Average depilation time*min)
Sodium	5.7
Lithium	5.7
Potassium	6.5
Barium	6.5
Calcium	7.1
Strontium	8.3

*****Average of times for the different mercaptans studied at pH 10.0 to 11.0. (Lowering the pH to 9.0 from about 10.0-11.0 lengthens the time for depilation.)

Table 9: Top hair removal brand.

Brand	**Manufacturer**
Veet hair removal cream	Reckitt Benckiser, USA
VI-John hair removal cream	Vi-Jon Laboratories, Missouri, U.S.
Fem	Dabur, India
Sally Hansen cream hair remover kit	Sally Hansen, New York, USA
Olay Smooth Finish Facial Hair Removal Duo Fine to Medium Hair 1 Kit	Procter & Gamble, USA