



Folklore Herbal Plants as a Safe and Natural Hair Depilatories

**Kalakotla Shanker^{1*}, Shamshe Shaik¹, V. Vijayanandhan¹,
Tamatam Sunilkumar Reddy¹, Rabiatal Basria S. M. N. Mydin²
and S. P. Dhanabal¹**

¹*Department of Pharmacognosy and Phyto Pharmacy, JSS College of Pharmacy, JSS Academy of Higher Education and Research, Ooty, Nilgiris, Tamil Nadu, India.*

²*Oncological and Radiological Sciences Cluster, Advanced Medical and Dental Institute, University Sains Malaysia, Bertam, 13200, Kepala Batas, Pulau Pinang, Malaysia.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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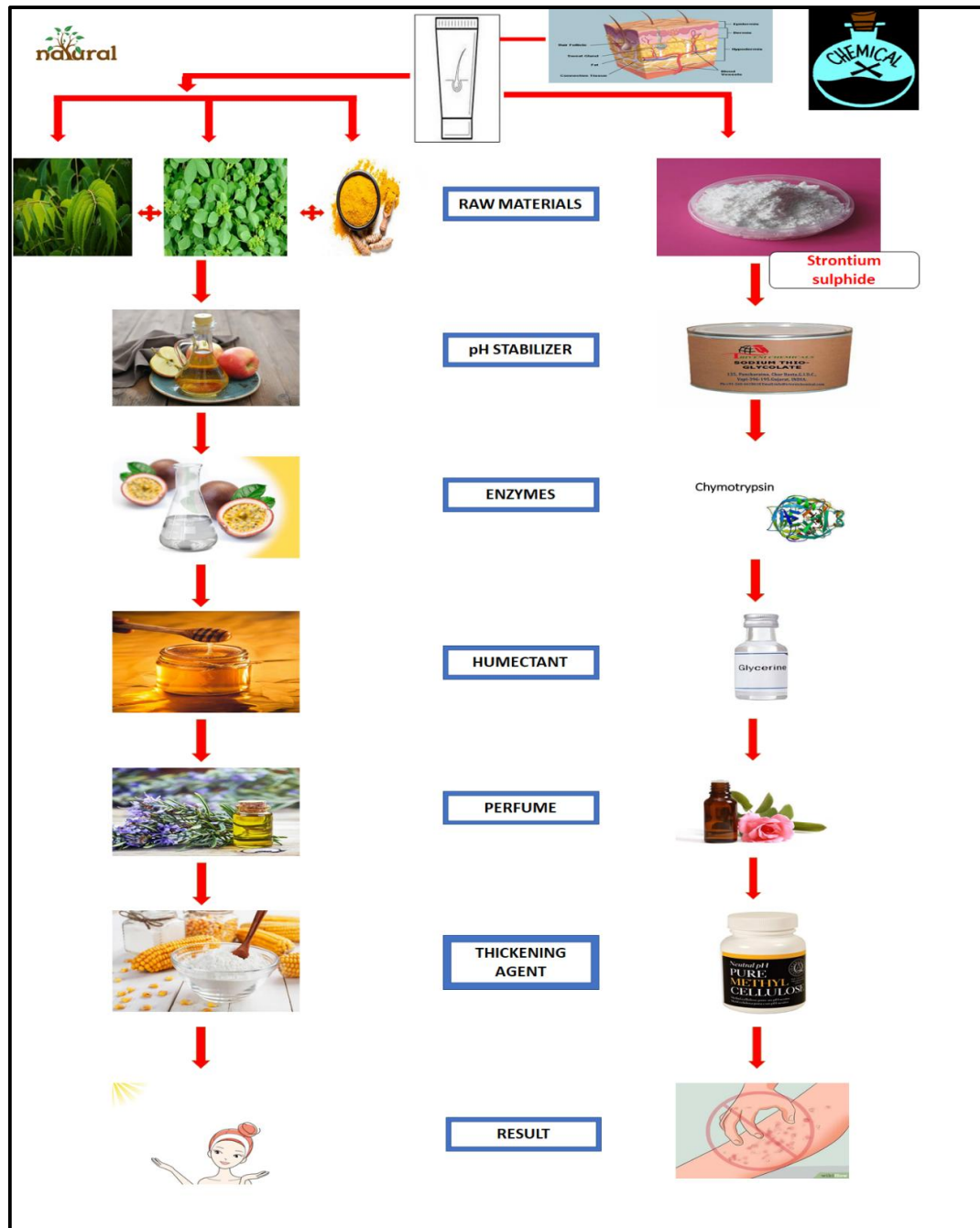
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ABSTRACT

Hair is one of the distinguishing characteristics of mammals, and it serves a variety of functions including protection from external forces, production of sebum, apocrine sweat, and pheromones. However, the unwanted hair growth is always a worrying aspect among teenage girls and women. The present study is the need of selecting herbal depilatories over chemical depilatories due to its high efficacy, safety and lesser side effects. The various types of hair removal process, herbs showing depilatory action and their composition for herbal cream are studied. According to statistics, the use of depilatories has been steadily expanding, and the global hair removal products market was valued at US\$ 2.2 billion in 2018, with a CAGR of 5.5 percent predicted from 2019 to 2025. Depilatories are the cosmetic preparation which is used to remove the hair from skin, in chemical depilatories the main active ingredients are salts of thioglycolic acids, sulphides and stannites which can produce rashes and side effects on long time usage, whereas herbal depilatories include active ingredients like Turmeric, Indian nettle, Neem, Tanner's cassia, Apple cider vinegar, Paw-paw extract etc. which are tremendously safe to use. Hence in this study we

*Corresponding author: E-mail: drshanker@jssuni.edu.in;

have been discussed about importance of few folklore herbal medicine and preparation methods of both chemical and herbal depilatories.



Graphical Abstract

Keywords: Herbal depilatories; safety; side effects; folklore herbal medicine; chemical depilatories.

1. INTRODUCTION

Hair is a thin, flexible shaft of cornified cells that grows from the hair follicle, which is a cylindrical invagination of the epidermis. Hair is mostly made up of amino acids, some of which contain sulphur and cystine, which is the most abundant amino acid in hair [1]. These acids are frequently referred to as keratin. Products used for the removal of unwanted hair are commonly known as depilatories. The requirements of a depilatory are that it should be non-irritating, innocuous, efficient in action, odorless or should have pleasant odor [2]. During the times hair growth in face is found to be worrying aspect among teenage girls and women. Generally, when compared to men women won't get facial hairs but due to improper food diet and hormonal imbalance, now a day's women are at high risk of having facial hairs. Hair is a resistant material which is not readily dissolved or destroyed and hence requires careful consideration for removing it. If it is pulled out, then it grows and gain its shape again. If it is destroyed by X-Ray the tissues are adversely affected and hence now-a-days this method is not in practice. Electrolysis is a suitable method for permanent removal but is slow and costly [3]. When chemical removal is used danger of irritation is present. So, our main aim of review is to find herbal depilatories, so that it will be safe for use and does not produce any side effects. During ancient times, turmeric was applied daily by women during bath but in this century in the midst of busy world this is not possible and due the staining property most of them are avoiding it but other than turmeric there are many herbs and essential oils which plays a key role in inhibition of hair growth. [4].

1.1 Hair Removal Processes

Five types of hair removal processes:

1. Epilation:

Epilation is the removal of all hair, including the hair beneath the skin. Waxing, sugaring, lasers, threading, epilation devices, and plucking with tweezers have all been shown to be effective epilation methods [5].

2. Waxing:

Waxing is number two. Because it eliminates the hair from the root, waxing is also known as semi-permanent hair removal. Waxing can be done on almost any part of the body, including the

eyebrows, face, legs, arms, back, abdomen, and feet [6].

- **Soft warm wax:**

Strip waxing, which is cream or resin-based, is also known as soft warm waxing. It's softly warmed before application, then applied as a thin layer to the skin, pressed with a cotton strip, then removed, leaving the hairs behind. Larger areas, such as the legs and arms, are usually covered with spreadable wax. Because soft wax adheres to the cells of the skin, it should only be used once per area [7].

- **Hard wax:**

Hard wax is sometimes known as strip-free wax since it functions as a strip when hardened. Hard wax can be used on places with thicker hair as well as finer, thinner hair. Warm wax is applied, and as it cools, it solidifies. To protect the skin, a tiny amount of pre-epilation oil is administered. As the wax solidifies, it shrink-wraps the hairs rather than clinging to the skin like soft wax, making it more ideal for smaller, more sensitive places like the lip, nose, and underarms, whereas it can cause hair breakage towards the end of the draw on larger areas [8].

- **Cold soft wax:**

Cold wax is a type of wax that is applied straight to the skin and sold in strips. Cold soft wax has the advantage of not burning the skin like hot wax does, but it is less effective and leaves less hairs on the skin. It's also been found that removing cold wax causes more discomfort than removing heated wax [9].

- **Wax strips with the right amount of cold soft wax:**

Wax strips with the right amount of cold soft wax are already attached and ready to use. This method is recommended for beginners because it is the most user-friendly and mess-free. A strip can be used more than once per area depending on how much hair you're removing. This is a handier alternative for travelling because it involves the least amount of preparation and has the fewest moving parts of the production process [10].

- **Fruit wax:**

Fruit enzymes and extracts from papaya, strawberry, pomegranate, cranberry, and plum provide additional skin benefits, making it less

like hard wax. While removing hair, the soft wax feeds the skin with antioxidants and vitamins. Fruit wax is better for sensitive skin because it doesn't produce bumps, rashes, or marks, but it's important to read the contents before applying it because some fruits may cause allergic reactions. As a result, it's important to double-check the constituents before using [11].

- **Chocolate wax:**

Chocolate wax is tender on the skin and known as one of the least painful types of wax. It hydrates the skin and also produces soothing effect. It also consists of nourishing ingredients like almond oil, soybean oil, sunflower oil, glycerin, vitamin E and other minerals. Naturally cocoa itself is rich with antioxidants and also acts as an emollient in the wax. Almond oil in the wax add more benefit since it has anti-inflammatory property. Chocolate wax is available as both soft and hard but both should be applied warm. Since it has low melting point it is unlikely to cause burns [12].

3. Threading:

Threading is when a thin cotton or polyester thread is twisted and rolled over areas of undesirable hair to pluck the hair from the root. Threading has the advantage over tweezing in that it can remove short rows of hair at a time, whereas tweezing can only remove one hair at a time, causing more pain and irritation [13].

4. Shaving:

Shaving is the removal of hair from the body using a razor or other bladed object to shave it down to the skin's level. Shaving is a popular practice for males to eliminate facial hair and for women to remove hair from their legs and underarms [14].

4. Depilatories:

Depilatories are preparations that use a chemical degradation process to remove hair. Depilatories act by causing hair to breakdown by destroying the disulphide linkages that connect the protein chains and give hair its strength. Depilatories are creams that remove hair from the surface without the discomfort of epilation [15].

1.2 Mechanism of Hair Removal Cream

Hair removal creams work by breaking down disulfide bonds, and calcium thioglycolate is

commonly used in this process. The thioglycolate salt disrupts the disulfide bonds in keratin, causing the hair's structure to break down. The hair becomes weak once these bonds are broken, and it can be easily removed from the skin by wiping and rubbing.

Hair removal creams usually contain approximately 5% of the active component thioglycolate, along with a number of additional chemicals. Metal hydroxides like NaOH and Ca(OH)₂ are commonly found in creams to help modify pH levels so that the active acid can react with cysteine residues in the hair [14,16]. Hair removal creams also contain a significant amount of water, which is used as a solvent to dilute and dissolve all of the components, resulting in a smooth, easy-to-apply cream. Emollients are also included in the cream to soothe the skin after application and prevent any reactions to the product's harsher chemicals. Oils and silicones are the most popular emollients, and they help to heal the skin after chemical hair removal [14].

1.3 Herbal Plants with Depilatory Action (Table 1)

Curcuma longa is a rhizomatous herbaceous perennial plant native to tropical South Asia and a member of the Zingiberaceae ginger family [17]. Turmeric includes turmerone as well as other coloring compounds known as curcuminoids, in its volatile oil. Curcuminoids, which include curcumin demethoxycurcumin, 5'-methoxycurcumin, and dihydrocurcumin, are natural antioxidants [18,19]. Turmeric is a spice that is used to treat rheumatoid arthritis, chronic anterior uveitis, conjunctivitis, skin cancer, and smallpox. It is also used to treat chicken pox, wound healing, urinary tract infections, and liver problems [20]. It's also used to treat digestive issues, flatulence, jaundice, menstruation problems, and colic, as well as abdominal pain and distension [21]. Turmeric is also utilized as a depilatory by traditional healers when combined with other medicinal herbs.

1. Thorowax root

The "Bupleuri Radix" is the root of *Bupleurum falcatum* L. belonging to the family of *Umbelliferae*. 'Bei chaihu' (Northern Chinese Thorowax Root) and the dried roots of *Bupleurum scorzonerifolium* known as 'Nan chaihu', are used in therapeutic practice. In China, *Radix bupleuri* is traditionally used to

Table 1. List herbal plants with depilatory activity

S.No	Plant/common name	Botanical name	Part used
1	Turmeric	<i>Curcuma longa</i>	Rhizome [17]
2	Wild turmeric	<i>Curcuma aromatica</i>	Rhizome [24]
3	Thorowax root	<i>Bupleuri radix</i>	Root [22]
4	Neem	<i>Azadirachta indica</i>	Leaf [25]
5	Indian nettle	<i>Acalypha indica</i>	Leaf [26]
6	Tanner's cassia	<i>Senna auriculata</i>	Leaf [27]

relieve fever, to calm the liver and to cure drooping and ptosis [22]. According to the United States patent, thorowax root shows depilatory action [23].

2. Neem

Neem (*Azadirachta indica*) is an Indian evergreen tree. Ayurvedic medicine has historically utilized neem extract for asthma, constipation, cough, diabetes, stomach ulcers, indigestion, periodontal disease, and urinary tract infection. Inflammation, liver health, pain alleviation, eye health, immune system boosting, and heart disease prevention are all reported to benefit from neem. Neem can be purchased as a pill, tincture, powder, oil, cream, or mouthwash. While neem oil is used to treat acne and dandruff on the scalp. It also helps in treating dry skin and wrinkles, stimulates collagen production, reduces scars and heals wounds. Neem leaf extract is taken orally. The bark, blooms, and fruit of the neem tree are all used medicinally in some circumstances [25].

3. Indian nettle

The herb is known as Kuppaimeni in Tamil. *Acalypha Indica* is the botanical name for Kuppaimeni, which is a member of the *Acalypha* genus of the *Euphorbiaceae* family. This plant is also known as Kuppamini in Malayalam, Kuppigida in Kannada, Kuppikhokli in Hindi, Haritamanjari in Sanskrit, Kuppi Chettu in Telugu, Khajoti in Marathi, Herbechate in French, Kuppameniya in Sinhalese, and Mukhtajhuri in Bengali. Many of the great medical applications of kuppaimeni can be attributed to 9-tricosene, Phytol, MOME inositol, Dihydroactinidiolide, Loliolide, Docosanol, 1-Eicosanal, 1-Triacontanol, Octocosanol, Tricosanal, and other bioactive compounds found in the plant. phenolic compounds, alkaloids, catechols, flavonoids, phenolic chemicals, saponins, and steroids abound in Kuppaimeni. Phytol, dihydroactinidiolide, and loliolide are three of these chemicals. Indian nettle has traditionally been used as a depilatory [26].

4. Tanner's cassia

Senna auriculata is a leguminous tree belonging to the Caesalpinoideae subfamily. Local names include matura tea tree, avaram, and ranawara, as well as the English name avaram Senna. It is Telangana's state flower. It can be found in India's and Sri Lanka's arid regions. In Sri Lanka, it's common along the shore and in the arid zone. Avaram - Senna is a shrub with many branches and alternating, many, closely spaced leaves that are 8.8 to 12.5 cm long and dull green, with cinnamon brown bark. It has bisexual flowers that are bright yellow in color and big, measuring around 5 cm in length. The fruit, which resembles a bean and contains 20-25 seeds, is roughly 7.5 to 11 cm long and 1.5 cm wide., It has a pale brown tint and is flat and thin. It exhibits medicinal applications such as leprosy, asthma, joint pain, diabetes, eye diseases, skin infections, gonorrhoea, diabetes, and gout. Flavonoids, proanthocyanisidin, Butanol, anthraquinones, and tannins are chemical components of *Senna auriculata*. Cosmetically it treats uneven skin tone and improves skin complexion. Frequent use of this Tanner's cassia makes the skin blemish free and clears black spots [27].

1.4 Composition of Herbal Depilatory Cream

(A) pH stabilizer

The pH scale and the acidity or alkalinity of a substance are essential factors to consider when selecting cosmetics. Only when our skin has the appropriate pH level, 5.5, can it perform at its best. This changes the pH of the skin, making it less acidic [28].

Examples:

1. *Aloe vera (Aloe barbadensis)*: Family: *Asphodelaceae(Liliaceae)*
2. *Vitamin C (Ascorbic Acid)*: A water soluble vitamin found in citrus fruits and green vegetables.
3. Cider vinegar, or apple cider vinegar

It's an apple juice vinegar that's been fermented. It's prepared by crushing apples and then pressing the juice out. To initiate the alcoholic fermentation process, bacteria and yeast are added to the liquid, which converts the sugar to alcohol. Acetic acid-forming bacteria convert the alcohol into vinegar in a second fermentation stage (*Acetobacter* species). Vinegar's sour flavor comes from a combination of acetic and malic acids [29].

(B) Enzymes as anti-free radicals

One area where the topical application of enzymes has been shown to have significant benefits is in skin protection. There are several materials which have exceptional cosmetic stability. They are enzymes that have the potential to bind free radicals, preventing skin damage caused by pollution, bacteria, smoking, radiation, and other potentially harmful factors. The enzyme can successfully work on the skin's surface here [30].

Examples:

1. Paw paw extract (*Asimina triloba*); Family: *Annonaceae*
2. Passion fruit extract (*Passiflora edulis*); Family: *Passifloraceae*

(C) Humectants

Humectants are chemicals that are commonly used in the cosmetics and food sectors to enhance the moisture content of finished products including face moisturizers and packed, baked cakes. Glycerin, for example, is used by both industries for its humectant properties [31].

Examples:

1. Honey (*Apis mellifera*); Family: *Apidae*

(D) Perfumes

Natural fragrances are complex compounds produced by extracting natural aromatics from plants without modifying their chemical structure. Essential oils, oleoresins, distillates, fractions, and isolates are one of the substances present in naturally derived fragrances [32].

Examples:

1. Rose oil (*Rosa Pisocarpa*); Family: *Rosaceae*.

2. Rosemary (*Salvia rosmarinus*); Family: *Lamiaceae*
3. Lavender (*Lavandula*); Family: *Lamiaceae*

(E) Thickening agents

Thickening agents generally play most important role in cosmetic formulation, not only to regulate the product viscosity but also to maximize the rheological properties of stability [33].

Examples:

1. Corn Starch (*Foeniculum Vulgare*); Family: *Poaceae*
2. Guar gum (*Cyamopsis tetragonoloba*); Family: *Fabaceae*
3. Gelatin

Gelatin is a product obtained by the partial hydrolysis of collagen, derived from the skin, white connective tissue, tendons, ligament and bones of ox (*Bos taurus Linn.*), sheep (*Ovisaries Linn.*), etc. Family: *Bovidae* [34].

1.5 Traditional Healer's Treatment

According to non-codified medicines, for depilatory action they are using Indian nettle leaf powder or extract with neem leaf powder or extract and turmeric powder as a paste and applying as a mask for 10-15 mins daily before bath. While doing continuously for 30-45 days it weakens the hair from root naturally and starts to fall off but this treatment works more effective when started at early stage. So Matured hairs situated in legs, hands and armpits does not show's tremendous effect for this paste [35].

1.6 Composition of Chemical Depilatories

A chemical depilatory is a cosmetic product used to remove unwanted hair from the skin. Salts of thioglycolic acid and thiolactic acid are the most prevalent active components in these chemical depilatories. These substances dissolve the disulphide link in keratin and hydrolyze the hair, allowing it to be readily removed. Sulphides, such as strontium sulphide, are employed, however they have been supplanted by thiols due to their unpleasant odour. To minimize runoff, it comprises 5-6 percent calcium thioglycolate in a cream base. To maintain a pH of 12, calcium hydroxide or strontium hydroxide is utilized [36].

(A) Inorganic sulphides

Barium sulphide is found to be highly toxic whereas calcium sulphide is found to be less toxic but exhibits less efficacy. Whereas strontium sulphide is considered as better choice because it shows its action within 3 minutes. The main disadvantage of inorganic sulphides is the unpleasant odor [37].

(B) Thioglycolates

Thioglycolates are used in conjugation with alkali. For hair removal 2.5- 4% of calcium thioglycolate in conjugation with calcium hydroxide at pH 11-12 about 5-15 minutes is used. It is found to be less toxic and less odor when compared with sulphides [38].

(C) Stannites

Sodium stannite is commonly used for depilatory action. It is found to be strongly reducing and exhibits alkaline effect when reacted with water [39].

(D) Enzymes

3-4% of keratinase enzyme is used for depilatory action. It also has an advantage of being nonirritant and odorless in nature [40].

(E) Other additives

Glycerin and sorbitol are commonly used humectants. Starch, methylcellulose and mucin are used as thickening agent [41].

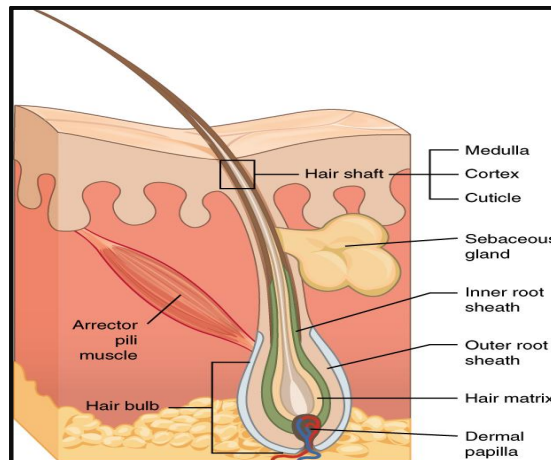


Fig. 1. Structure of hair

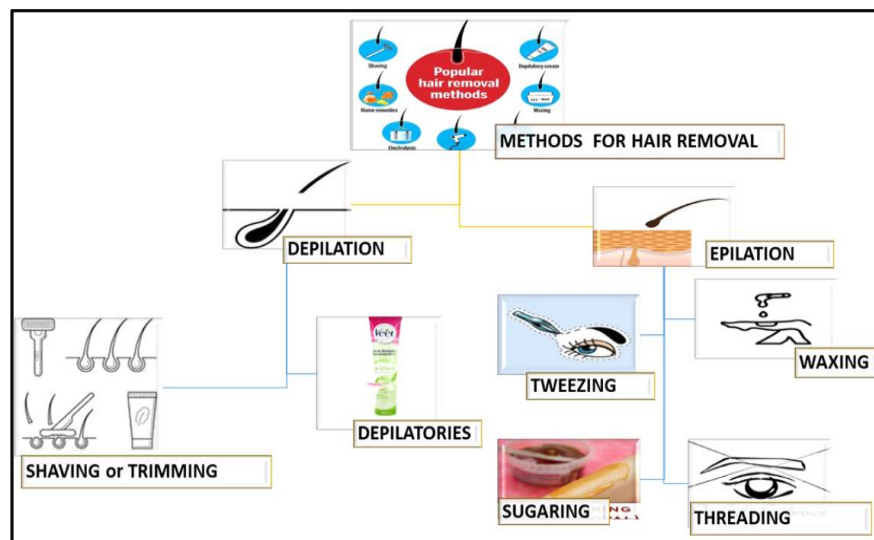


Fig. 2. Types of hair removal processes

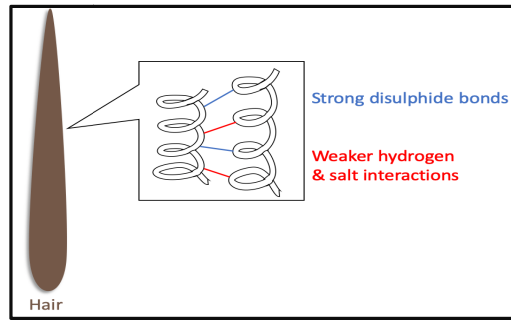


Fig. 3. Composition/hydrogen & salt interactions of hair

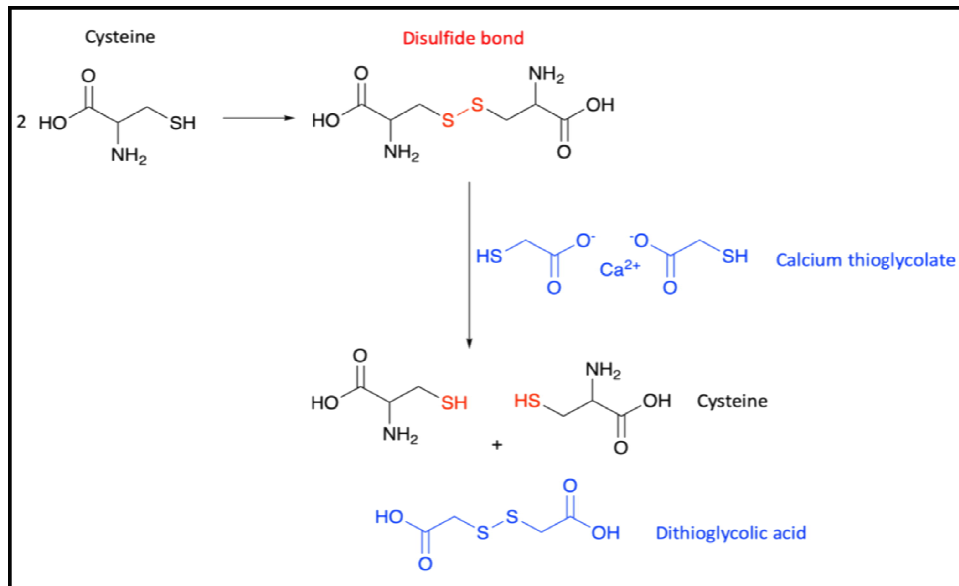


Fig. 4. Hair removal chemical mechanism

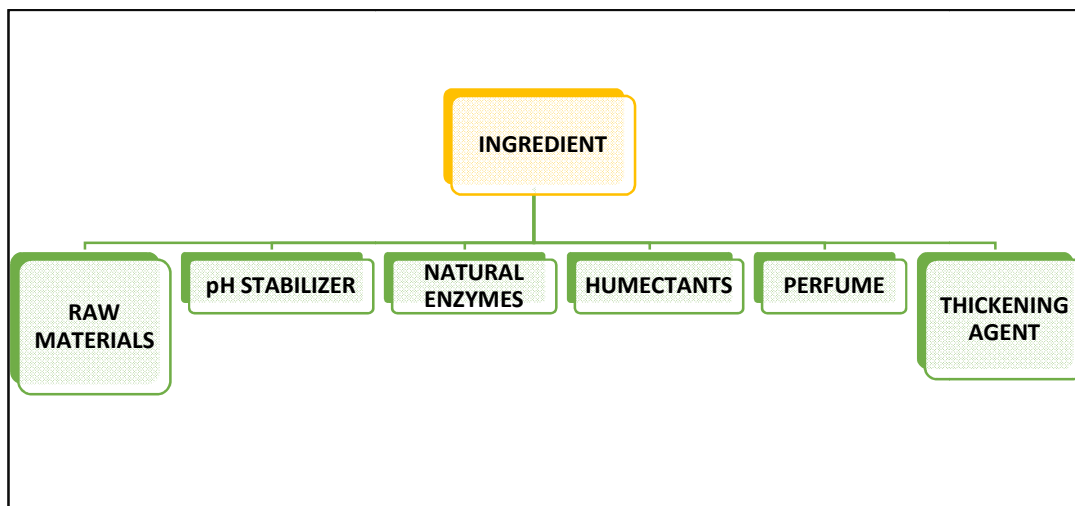


Fig. 5. Composition of herbal depilatory cream

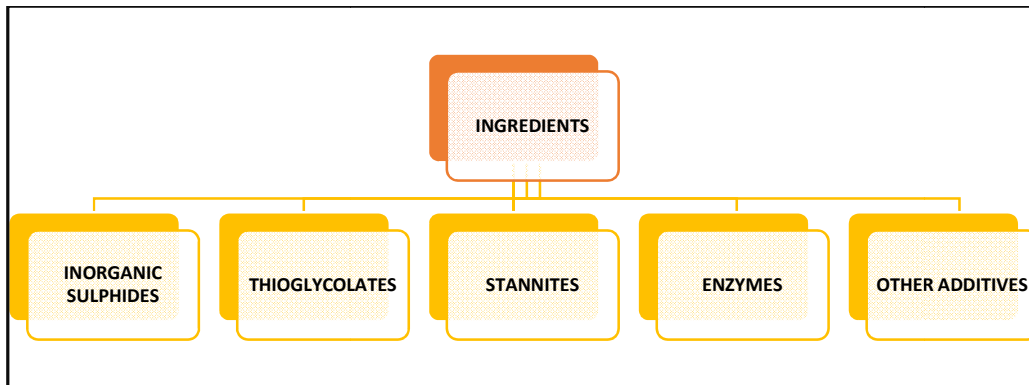


Fig. 6. Chemical composition of synthetic depilatories [42]

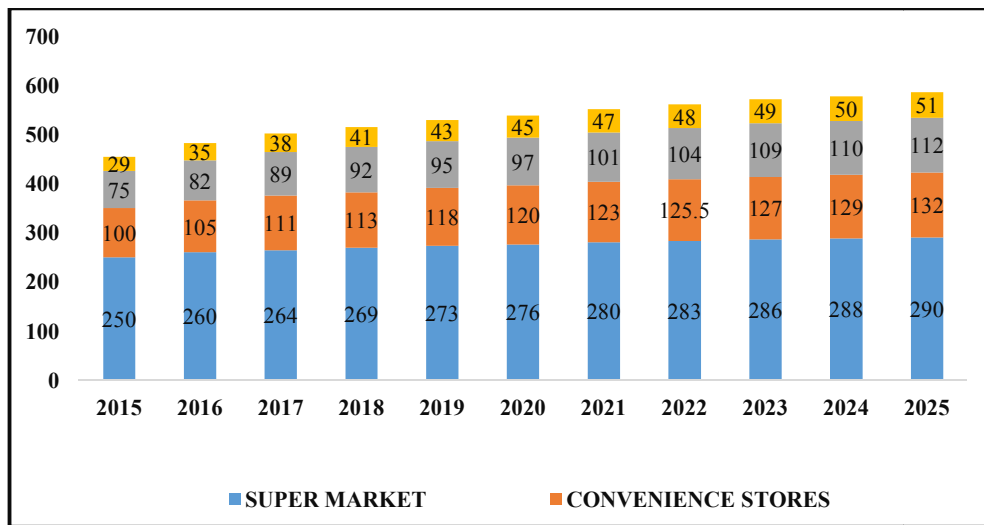


Fig. 7. Hair removal products market size by distribution channel 2015-2025

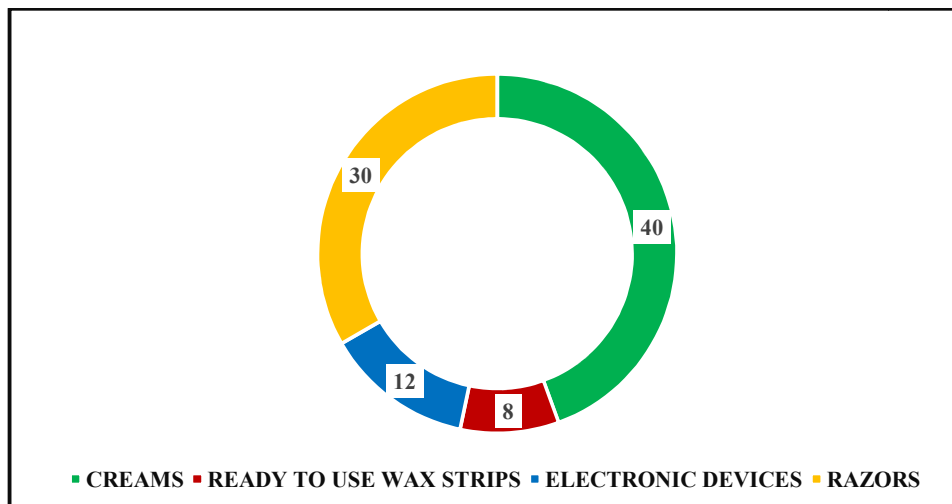


Fig. 8. Consumption of various hair removal products [43]

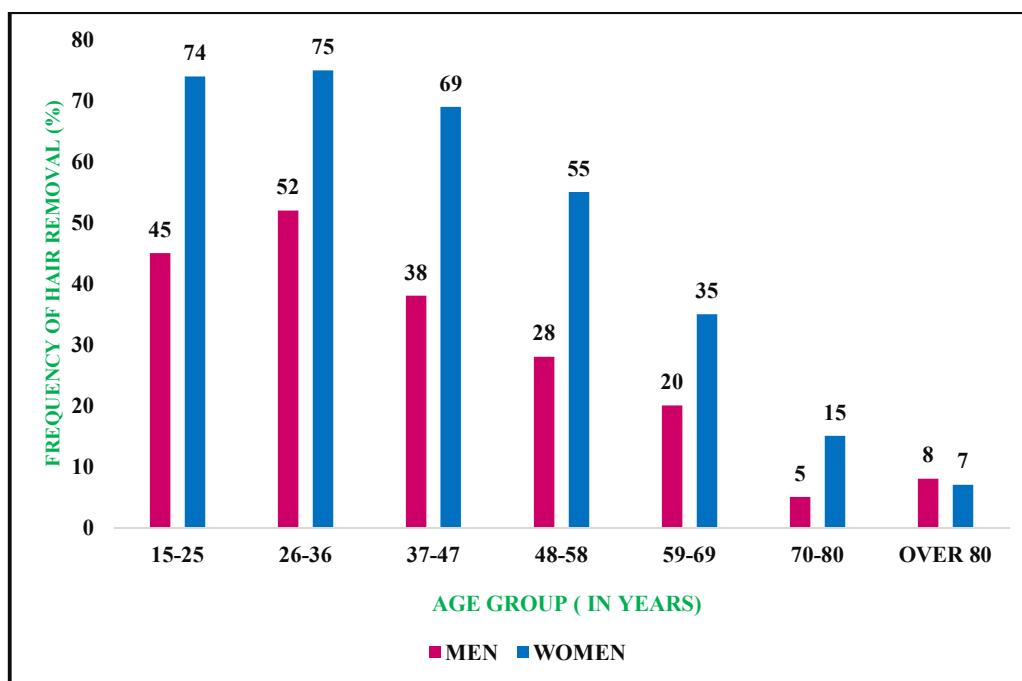


Fig. 9. Different age groups using hair removal products [44]

1.7 Statistical Data on Hair Removal Products

The global hair removal products market size was valued at USD 2.2 billion in 2018 and is expected to expand at a CAGR of 5.5% from 2019 to 2025. Rising consciousness with respect to personal grooming and enhancing aesthetic appeal are some of the factors fueling the growth of the global market.

2. CONCLUSION

The end user's ability to employ herbal substances and plants in everyday life has greatly improved. Herbal plants contain phytoconstituents that have potential medicinal and hair depilatory properties. People can buy hair removal creams without a doctor's prescription, which is one of the advantages of herbal depilatory creams. These creams are also economical than other chemical expensive creams. they need minimum clean up when used in shower. Depilatory creams have a poor reputation for smelling like harsh chemicals, but nowadays, most high-quality hair removal products have pleasant fragrances. These lotions dissolve dead skin cells and also hair, exfoliating the skin and decrease the possibility of ingrown hairs. Chemical depilatory creams have a

number of drawbacks, the most significant of which being their chemical composition. Depilatory lotions contain chemicals that destroy hair, which can cause skin irritation. Depilatory creams also grow back considerably faster than other hair removal techniques since they do not remove unwanted hair at the root. As a result, using natural herbal depilatories, which have no side effects on the skin, is a better choice than using chemical depilatories. There are a few herbs that have the ability to remove hair from the root without causing skin irritation. Herbal depilatories require greater research and optimization studies, which will lead in a maximum reach in the market while also being eco-friendly.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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