Vol 3|Issue 2| 2013 |71-73.

International Journal
of
Pharmacy Review & Research
www.ijprr.com

e-ISSN: 2248 – 9207
Print ISSN: 2248 – 9193

A SHORT COMMUNICATION ON FORMULATION AND EVALUATION OF DEPILATORIES

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ABSTRACT

Depilatory is a cosmetic preparation used to remove hair from the skin on the human body. Currently, common active ingredients are calcium thioglycolate or potassium thioglycolate, which breaks down the disulfide bonds in keratin and weakens the hair so that it is easily scraped off where it emerges from the hair follicle.This review focuses the design of formulation and evaluation parameters of depilatories.

Key words: Depilatories, Formulation and Evaluation.

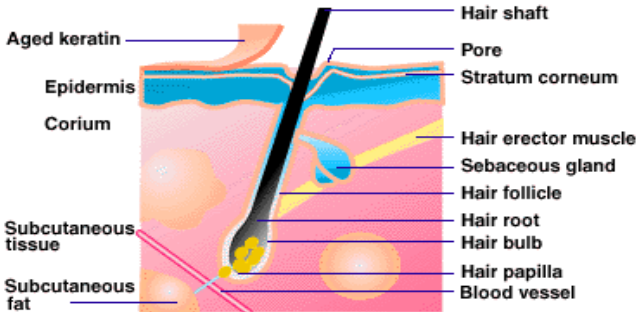
INTRODUCTION

The term depilatory must therefore be reserved for chemical means of hair removal from skin (in particular superfluous hair occurring on the face, legs, axilla, etc), without causing any injury to the skin [1]. It is definitely different from other methods of hair removal, which includes:

a) Mechanical removal of hair
b) Destruction of hair by use of laser energy
c) Shaving

Mechanism of action

Hair is composed primarily of proteins (88%). These proteins are of a hard fibrous type known as keratin. They are proteins, long chains of amino acids. Keratin proteins form the cytoskeleton of all epidermal cells. The amino acid cysteine is a key component of the keratin proteins in hair fiber. The sulfur in the cysteine molecule links together by disulfide chemical bonds. These disulfide bonds are very strong and very difficult to break apart. These disulfide chemical bonds linking the keratins together are the key factor in the durability and resistance of hair fiber to degradation under environmental stress. They are largely resistant to the action of acids but the disulfide bonds can be broken apart by alkali solutions [2].



Hence care should be taken, while formulating a depilatory, to ensure that the preparation reacts with the hair preferentially and that its effects will be sufficiently rapid to cause disintegration of the hair, before causing any damage to the underlying and the surrounding skin [3]. Thus, the qualities of an ideal depilatory should be as follows:

- Non toxic and non irritant to the skin
- Fast and efficient in action, preferably causing depilation within five minutes
- Preferably odourless
- Should be stable upon storage
- Non-staining/damaging to the clothing
- Cosmetically elegant

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FORMULATION OF DEPILATORIES

Chemical depilatories are sold in the form of liquids, pastes and powders. The most popular type of depilatories are the pastes and the powders. Typical ingredients of a chemical depilatory include-

- Alkaline reducing agent(s)
- Perfume(s)
- Emulsifier(s)
- Emolient(s)
- Thickening agent(s)
- Humectant(s)
- Miscellaneous agent(s)

Alkaline reducing agent(s)

Depilatory preparations usually contain an alkaline reducing agent as their active component. These agents will cause the hair fibres to swell and cleave the cystine bridges between adjacent polypeptide chain; causing degradation of the hair. The common agents include.

(a) Sulphides:

Barium polysulphide was the first agent to be used and later, the sulphides (mono-/poly-sulphide and sulphydrate) of stromonium were also added. The formulations containing alkali and alkaline earth sulphides produce rapid depilation, particularly when a suspension of lime is used along with. Nowadays sodium sulphide has replaced with other milder agents.

Strontium sulphide has a milder action than sodium sulphide, but needs to be used at a much higher concentration. Sulphide containibg depilatories are less popular nowadays because they produce the odour of hydrogen sulphide on application. None-the-less, sulphide based depilatories have a comparatively rapid action, are thus preferred by many black skinned men for removing facial hair.

(b) Stannites

Stannites particularly soluble stannites, were employed to replace sulphides. Stannites offer the advantage that they do not have an appreciable odour but they tend to suffer from instability, forming stannates in the presence of water. A number of stabilizers, such as soluble silicates, triethanolamine, sugars, etc., were also tried but were not found to be effective and did not produce stable preparations.

(c) Substituted Mercaptans

These are the most widely used agents nowadays, and are used in conjunction with calcium hydroxide. Thioglycollic acid in the form of its alkaline salts is the agent of choice, and it is a common practice to blend sodium and calcium thioglycollate usually in ratios of 1:2 or 1:3 (Na to Ca). Calcium hydroxide, present in excess, serves to control the pH and also acts as an alkali reservoir. Other possible alkali reservoirs are strontium hydroxide and calcium silicate. However, the solubility of calcium and strontium hydroxides and thioglycolates might be a problem in some cases. Other thio compounds such as thiolactic acid, thioglycerol, etc., have been employed successfully in some formulations.

Perfumes

Most of the alkaline reducing agents, including salts of thioglycolic acid, have usually an odour of their own, while many others, particularly sulphides, generate the odour of hydrogen sulphide on application. Hence the use of perfumes is almost a necessity in depilatory products. The perfume materials used are aromatic alcohols, ketones, anise, safrol and rose. With improved manufacturing technology, the cosmetic industry has arrived at products (such as calcium thioglycolate) which are far less mal odorous than what was previously available.

Emulsifiers

The common emulsifiers used are mainly ethylene dioxide ethers of fatty alcohol soaps, sodium lauryl sulphate and other anionics are rarely used for reasons of cosmetic elegancy and potential irritancy.

Emollients

The common emollients used include mineral oils and paraffins.

Thickening agents

Synthetic thickening agents, such as methyl, hydroxyethyl or carboxyl methyl cellulose, are used. The earlier formulations employed the use of materials such as zinc stearate, talc, colloidal clay, titanium dioxide, starch, precipitated chalk, etc., or a suitable combination of these to make a paste of requisite consistency.

Humectants

Humectants such as glycerine, sorbitol, propylene glycol, etc., are incorporated to prevent quick drying on the skin.

Miscellaneous

Some other common ingredients of a depilatory product include.

- Enzymes
- Accelerators
- Hair growth retardants

EVALUATION OF DEPILATORIES

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 hair by 95% ($T_{95\%}$) was shown to correlate to in-vivo hair removal rate in commercial products.

HPLC Method

This method can distinguish between thioglcerol, thiolactic acid 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 thermomechanical 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.

Miscellaneous methods

- TLC and GLC methods
- Index of depilatory effectiveness
- Determination of pH
- Determination of Calcium thioglycolate and thermal stability

SOME FORMULATIONS OF CHEMICAL DEPILATORIES ARE GIVEN BELOW

Depilatory Powder

Formula	**%**
Titanium dioxide	23
Barium sulfide	35
Wheat starch	40
Menthol	0.2
Perfume	1.8

Method: Dissolve the menthol in perfume oil, and add some starch to it by rubbing. Sift the titanium dioxide and barium sulfide together. Then mix and sift the remaining starch, and next add it to the menthol-perfume mixture. Mix the entire batch for about half an hour, and then pack.

Depilatory paste

Formula	**%**
Strontium sulphide	20
Talc	20
Methyl cellulose	3
Glycerine	15
Water	42

Method: Dissolve methyl cellulose into water and mix glycerine with it. Sift strontium sulphide and talc into the above mixture, slowly and stir thoroughly, until a smooth paste is obtained.

Depilatory Cream

Formula		**%**
A	Magnesium aluminium silicate	3.50
	Tetra sodium EDTA	1
	PEG 400	4
	Water	65.20
B	Mink oil	4
	Ceteareth	8.8
	Cetyl alcohol	1
C	Calcium thioglycolate	5.5
	Calcium hydroxide	6.5
D	Fragrance	0.50

Method: Heat (A) to 90ºC, hold with sheer agitation for 20 minutes. Cool to 75ºC, add premelted (B). Gradually cool, continue the agitation to 55ºC. Add (C). Product will thin out upon adding (C). Gradually cool to 40-45ºC, with agitation and add the fragrance and mix.

Depilatory lotion

Formula		**%**
A	Magnesium aluminium silicate	1
	Deionized water	74
B	Propylene glycol	5
C	Mineral oil and lanolin alcohol, PEG 100	2
D	Calcium thioglycolate	5.5
	Calcium hydroxide	6.5
E	Preservative, dye and Fragrance	0.50

Method: slowly add magnesium aluminium silicate to the water, while agitating at maximum available shear. Continue mixing until smooth. Add (B) to (A). Heat (C) to 70ºC, then add with stirring. Cool to 45ºC, add Calcium thioglycolate and stir. Add Calcium hydroxide, stir until cool and uniform, Add (E).

ACKNOWLEDGEMENT

Authors are grateful thanks to management of Anurag Pharmacy College, Kodad.

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