

[54] **DEPILATORY COMPOSITION AND METHOD OF USE**

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[*] Notice: The portion of the term of this patent subsequent to Aug. 5, 1986, has been disclaimed.

[22] Filed: **Sept. 22, 1972**

[21] Appl. No.: **291,305**

Related U.S. Application Data

[63] Continuation of Ser. No. 83,246, Oct. 22, 1970, abandoned, which is a continuation-in-part of Ser. No. 834,894, June 19, 1969, abandoned, which is a continuation-in-part of Ser. No. 533,236, March 10, 1966, Pat. No. 3,459,198.

[52] U.S. Cl. **8/161**

[51] Int. Cl. **A61k 7/14**

[58] **Field of Search**..... 8/160, 161

[56] **References Cited**

UNITED STATES PATENTS

3,459,198 8/1969 Zemlin et al. 424/71

Primary Examiner—Sam Rosen

Attorney, Agent, or Firm—Wolf, Greenfield & Sacks

[57] **ABSTRACT**

A means and method of removing hair from the skin of the body comprises applying a 1,4 dimercapto -2,3 butane diol to the hair at the skin at a pH of from 7 to 13. The 1,4 dimercapto -2,3 butane diol or substituted product thereof is permitted to react with the hair until depilatory action is carried out after which the hair and reaction products are removed from the skin. Preferably calcium ions are used in conjunction with the 1,4 dimercapto -2,3 butane diol or substituted product thereof to increase the speed of hair removal.

13 Claims, No Drawings

DEPILATORY COMPOSITION AND METHOD OF USE

RELATED APPLICATIONS

This is a continuation of application Ser. No. 83,246 filed Oct. 22, 1970 (now abandoned) which is a continuation-in-part application of Ser. No. 834,894 filed June 19, 1969 (now abandoned) which is a continuation-in-part of application Ser. No. 533,236 filed Mar. 10, 1966 which issued Aug. 5, 1969 as U.S. Pat. No. 3,459,198.

BACKGROUND OF THE INVENTION

Human hair has been removed from the skin of the body for medical and cosmetic reasons by various means and methods throughout the ages. In recent times, depilatory means and methods involve a chemical approach for removing hair which often consists of applying strongly alkaline sulfides and sulfhydrates in solution form to the skin. Problems arise with these compounds in that the very high alkalinity normally used is often irritating to the skin and the solutions often have vapors that are extremely obnoxious and in some cases toxic.

Many newer chemical depilatory compositions today are mixtures based on calcium thioglycolate and calcium hydroxide. Practically all of these mixtures are also strongly alkaline, having pH's up to 13 and higher. The high alkalinity is needed with conventional materials to swell the hair so that the thioglycolate can penetrate the hair shaft and cause softening and dissolving of the hair by virtue of its reducing action on the disulfide cross links of the hair. This occurs since human hair is a high molecular weight protein consisting of long chains of protein cross linked by cystine disulfide bonds.

Although calcium thioglycolate preparations do have distinct advantages over older known sulfide and sulfhydrate solutions, they nevertheless are strongly alkaline and cause irritation to a high percentage of users. In addition, the depilatory action is relatively slow and the process of removing hair often become lengthy, sometimes involving waits of thirty minutes or over. The odor of the thioglycolates is extremely vile and difficult to eliminate or mask. Other known materials for use as depilatories have similar disadvantages.

An important object of this invention is to provide an advantageous means and method for removing human hair.

Another important object of this invention is to provide a means and method in accordance with the preceding object which is highly efficient employing only a limited quantity of materials and which acts rapidly with minimized skin irritation problems.

SUMMARY OF THE INVENTION

According to the invention, 1,4 dimercapto -2,3 butane diol or a substituted product thereof is applied to human hair at the skin of the body preferably in solution form in molar concentration of from 0.1 to 1.0M with a pH in the range of from 7 to 13. The solution is permitted to react with the hair until a depilatory action is carried out and then the reaction products, solution and hair are removed as by washing. Preferably the reaction is carried out at room temperature.

Preferably the 1,4 dimercapto -2,3 butane diol or substituted product thereof is used in an aqueous solu-

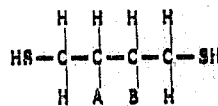
tion which also incorporates a swelling agent to swell the hair thus enabling faster reaction times, a wetting agent to cause the solution to rapidly wet the hair and where a paste rather than a free flowing liquid is desired, a thickening agent.

In the preferred form of the invention, the 1,4 dimercapto -2,3 butane diol or substituted product thereof in aqueous solution preferably has added thereto calcium ions with the solution being alkaline and having a pH in the range of from 8 to 12. The alkaline pH is preferably obtained by adding the calcium to the solution in the form of calcium hydroxide.

It is a feature of this invention that the present means and method is substantially non-irritating to the skin of users and carries out a depilatory action extremely rapidly.

DESCRIPTION OF PREFERRED EMBODIMENTS

According to the invention, 1,4 dimercapto -2,3 butane diol having the formula:



where A and B are hydroxyl groups, is used to reduce disulfide linkages of hair which hair can be easily washed from the skin. In the method of this invention hair is exposed to a swelling agent and contacted with a solution of 1,4 dimercapto -2,3 butane diol preferably at room temperature. It has been found that an unexpectedly small quantity of 1,4 dimercapto -2,3 butane diol is highly active to remove hair as compared with the previously used thiols and particularly thioglycolates such as calcium thioglycolate. Either the trans or cis form of the diol can be used. The efficiency of our compound is probably due to the formation of a stable ring compound after reaction with the disulfide linkages whereas thioglycolates participate in an equilibrium reaction where a substantial excess is required in order to have the reaction proceed.

While 1,4 dimercapto -2,3 butane diol in either of its isomer forms is preferred for use in this invention, one or both of the hydroxyl groups can be removed and substituted with other water soluble polar groups including $-\text{NH}_2$, $-\text{PO}_3\text{H}_2$, $-\text{COOH}$ and $-\text{SO}_3\text{H}$. When one of the hydroxyl groups is so substituted, hydrogen may be used for the remaining A or B group although this is not preferred. In some cases either one of the hydroxyl groups can be removed and substituted with hydrogen. Examples of suitable compounds are: (1,4 dimercapto -2 hydroxy-n-butyl) 3-phosphate, (1,4 dimercapto -2 hydroxy-n-butyl) 3-sulfonate, 1,4 dimercapto -2-amino -3 hydroxy butane, 1,4 dimercapto -2 hydroxy-3-carboxy butane, (1,4 dimercapto-n-butyl) 3-sulfonate as well as their salts. These materials are solids at room temperature. Thus, they can easily be packaged in convenient dry packages and since they are highly soluble in water or conventional swelling agents for hair, they can easily be dissolved just prior to application in a depilatory procedure.

The compounds of this invention are preferably used in aqueous solution at a concentration range of from 0.15 to 0.4 molar although the range may be 0.1 to 1.0 molar. Preferably the compounds are mixed in aqueous

solution with swelling agents, wetting agents and in some cases thickening agents.

Suitable swelling agents include water, organic or inorganic bases including potassium hydroxide, sodium hydroxide, calcium hydroxide, ammonium hydroxide, monoethanolamine, triethanolamine, morpholine, urea and others. These materials can also be employed to maintain the range of pH's employed within the range of from 7 to 13 and preferably 8 to 12. The swelling agents are used to swell the hair and permit faster reaction times for hair removal.

Calcium ions are preferably used in the 1,4 dimercapto -2,3 butane diol or substituted products thereof in aqueous solutions at pH's of from 8 to 12. The calcium is most conveniently added in the form of calcium hydroxide thus simultaneously obtaining the desired pH. The purpose of the calcium ions is to obtain faster reaction times at lower pH than other cations tested yet without causing skin irritation. Preferably no other cations are used in the aqueous solutions of the 1,4 dimercapto -2,3 butane diol or substituted products thereof when calcium ions are used. However, other cations may be present in minor amounts and preferably no more than 20 molar percent of the total cations present.

Suitable wetting agents for use in this invention include sodium lauryl sulfates, Ethoxylated alkyl phenols, sulfated diethoxy alkyl phenol, soaps such as sodium laurate, and other water soluble wetting agents which have well-known cosmetic use. The wetting agents are preferably used to lower surface tension and permit good wetting of the hair fibers by the aqueous solutions of this invention. The wetting agents preferably range in concentration from about 0.01 percent by weight up to 1 percent by weight of the solutions although higher concentrations can be used where particular effects are desired such as foaming, emulsification and the like.

In cases where a paste is desired rather than a liquid solution, thickening agents such as inert fillers includ-

ing clay, methyl cellulose, sodium carboxy methyl cellulose, ammonium polyacrylate, gum tragacanth, alginates, various emulsions such as combinations of lauryl sulfates with cetyl and stearyl alcohol, and others well-known to the cosmetic formulator can be used. In most cases, it is preferred to form a viscous solution to prevent liquid run off during use. However, the thickener is preferably used at a minimum concentration just sufficient to prevent such run off.

When calcium ions are used in the solutions of the 1,1 dimercapto -2,3 butane diol or substituted products thereof, care must be used in selecting the particular wetting and thickening agents if used, so that there is no interaction precipitating out both the calcium and the agents. For example, if sodium laurate, a commonly

used soap is used as the wetting agent, calcium ions should not be used since a precipitate would occur in the solution, thus, the swelling agents used must be selected without the use of calcium hydroxide.

Known thickening agents such as gum tragacanth, various alginates, various emulsions such as combinations of lauryl sulfates with cetyl and stearyl alcohol and the like which do not precipitate out are particularly useful when calcium ions as in the form of calcium hydroxide are employed in the solutions of this invention.

In the method of this invention, the compound of this invention is applied to the hair at the skin of the body preferably at room temperature although the temperature can vary considerably and is preferably in the range of from 60°F to 110°F. Higher temperatures increase the reaction rate. The only temperature limitation is that the temperature not cause discomfort to the skin of a user.

The reaction time necessary to have a depilatory action will vary depending upon the concentration and temperature. Preferably depilatory action is accomplished in from 2 to 10 minutes although as much as 30 minutes may be employed.

After application of the compound preferably in an aqueous solution, the solution is permitted to react with the hair until the depilatory action is carried out as evidenced by the hair's swollen appearance and loss of strength so that it is removed along with reaction products as by washing the skin with water.

The following illustrative examples indicate the effectiveness of the compounds of this invention as depilatories in rapid and efficient processes. It should be understood that these examples are illustrative only and are in no way limiting.

EXAMPLE 1

100 milliliters of a depilatory solution was prepared having the following formula:

1,4 dimercapto —2,3 butane diol	3.68	gms	(to make the final solution 0.2 molar)
Na ₂ HPO ₄ (buffer)	1.5	gms	
Sodium lauryl sulfate	.17	gms	
400 cps viscosity grade methyl cellulose	.25	gms	

Water was used to bring the volume to 100 mls and concentrated NaOH was then added until the pH was 12.0.

A small amount of the resulting slightly viscous solution was applied to a 2 inch square area of human forearm which was profusely covered with hair and the time required for hair removal was noted. In 5 minutes substantial softening of the hair and partial solution was observed. In 10 minutes the hair was completely removed from the treated area. No signs of irritation was observed.

EXAMPLE 2

In a similar fashion 100 mls of solution were prepared using the following amounts of material:

1,4 dimercapto —2,3 butane diol	7.36	gms	(to make the final solution 0.4 molar)
Urea	4.84	gms	(to make 0.8 molar solution)

- Continued

Sodium lauryl sulfate	.17	gms
4000 cps viscosity grade methyl cellulose	.25	gms

Water was added to bring the volume to 100 mls and then concentrated ammonium hydroxide was added drop-wise until the pH was 9.5.

This solution on the same human skin as in Example 1 gave slight hair removal in 5 minutes, considerable hair removal in 10 minutes, and complete hair removal in 15 minutes. No signs of irritation were noted.

EXAMPLE 3

25 mls solution of this invention were prepared using the following materials in the amounts noted:

1,4-dimercapto-2,3 butane diol	0.92	gms (to make the final solution 0.2 molar)
Sodium lauryl sulfate	42.0	milligrams

The sodium lauryl sulfate and 1,4 dimercapto -2,3 butane diol was added to water in an amount to form a final volume of 25 mls of solution. Calcium hydroxide was added to adjust the pH of the solution to 9.5. A small amount of the resultant solution was applied to a 2-inch square area of a living human forearm which was profusely covered with growing hair. The time required for hair removal was noted. In 7 minutes at standard room temperature, all hair was completely removed from the treated area. No signs of irritation were observed.

EXAMPLE 4

Example 3 is repeated but the amount of 1,4 dimercapto -2,3 butane diol is increased to 1.84 grams (to make the final solution 0.4 molar). Complete hair removal is obtained in 4 minutes.

EXAMPLE 5

Example 3 is repeated but the amount of 1,4 dimercapto -2,3 butane diol is increased to 3.68 grams (to make the solution 0.8 molar). The time required for complete hair removal is 3.5 minutes.

EXAMPLE 6

A 100 ml aqueous solution of this invention was formed in accordance with Example 3 containing 1,4 dimercapto -2,3 butane diol at 0.4 molar, polyethoxy isoocetylphenol (Triton X-100) 0.5 percent by weight, gum tragacanth 1.0 percent by weight and calcium hydroxide to adjust the pH to 9.5. The resultant solution is extremely viscous and does not run off the arm when tested as in Example 3. Complete hair removal is obtained in 4 ½ minutes with no skin irritation observed or felt by the subject.

When Example 6 is repeated with variations in the calcium hydroxide used to adjust the pH to 8 and 11.5 respectively, hair removal time is increased at the higher pH and decreased at the lower pH.

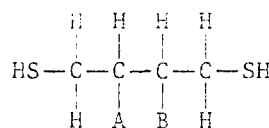
When the Triton X-100 and gum tragacanth are replaced in Example 6 by an emulsion of 4 percent by weight of the total solution of cetyl alcohol and one-half percent by weight sodium lauryl sulfate prepared

in one-half of the total water used in the solution, similar results are obtained as in Example 6.

It is a feature of this invention that a depilatory mixture can be formed in a dry package for sale to a user who can form a solution or paste by addition of water or some other solvent. In some cases, the dry packages can contain the swelling agents, wetting agents and/or thickening agents in separate packages. The amount of each material is predetermined to give sufficient depilatory action when mixed with a predetermined amount of water. The ratios of the various materials in solutions of this invention can vary greatly depending upon the times, temperatures and specific materials used.

What is claimed is:

1. A method of removing hair from the skin of the body comprising,
applying to the hair at the skin an aqueous solution of a compound having the formula



wherein A is selected from the group consisting of hydrogen and a water soluble polar group,

B is a water soluble polar group, said solution having said compound present in a concentration of from 0.1 to 1.0M with a pH of from 7 to 13, permitting said solution to react with said hair for a period of up to 30 minutes until a depilatory action is carried out,

and removing said solution from said skin along with reaction products and hair.

2. A method in accordance with the method of claim 1 wherein said compound is 1,4 dimercapto -2,3 butane diol.

3. A method in accordance with the method of claim 1 wherein each said water soluble, polar group is selected from the group consisting of $-\text{OH}$, $-\text{NH}_2$, $-\text{PO}_3\text{H}_2$, $-\text{COOH}$ and $-\text{SO}_3\text{H}$.

4. A method in accordance with the method of claim 1 wherein in addition said solution contains calcium ions in an amount sufficient to obtain rapid depilatory reactions at a pH in the range of from 7 to 13.

5. A method in accordance with the method of claim 1 wherein said solution comprises calcium hydroxide in an amount sufficient to form the pH of the solution to a value of from 8 to 12.

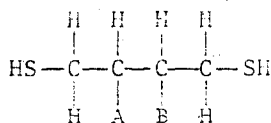
6. A method in accordance with the method of claim 2 wherein in addition said solution contains calcium ions in an amount sufficient to obtain rapid depilatory reactions at a pH in the range of from 7 to 13.

7. A method in accordance with the method of claim 2 wherein said solution comprises calcium hydroxide in an amount sufficient to form the pH of the solution to a value of from 8 to 12.

8. A method in accordance with the method of claim 2 wherein said solution is permitted to react for a period of from 2 to 15 minutes.

9. An aqueous depilatory solution for use in removing hair from human skin,
said solution comprising,

an effective amount of a compatible swelling agent and wetting agent, and a compound having the formula



wherein A is selected from the group consisting of hydrogen and a water soluble polar group,

B is a water soluble polar group, said compound present in a concentration of from 0.1 to 1.0M with a pH of from 7 to 13.

10. An aqueous depilatory solution in accordance with claim 9 wherein said compound is 1,4 dimercapto-2,3 butane diol.

11. An aqueous depilatory solution in accordance with claim 10 wherein said swelling agent is calcium hydroxide.

12. An aqueous depilatory solution in accordance with claim 9 and further comprising calcium ions in an amount sufficient to obtain rapid depilatory reactions at a pH in the range of from 7 to 13.

13. The aqueous depilatory composition of claim 10 converted into a paste consistency by incorporating therein an effective amount of a compatible thickening agent.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,865,546 Dated Feb. 11, 1975

Inventor(s) John C. Zemlin and Katherine A. Bowler

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3; line 59, change "1,1" to --1,4--.

Column 4, line 58, cancel "was" and substitute --were--.

Signed and sealed this 15th day of April 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
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