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## STABLE COSMETIC PREPARATIONS CONTAINING DIHYDROXY ACETONE

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This invention relates to stable cosmetic preparations, either in the form of lotions or creams, containing dihydroxy acetone.

Dihydroxy acetone is an industrially important chemical, produced commercially by the dehydrogenation or oxidation of glycerol by certain acetic acid bacteria (cf. Industrial Microbiology, Prescott and Dunn, 1940). The fact that dihydroxy acetone reacts with protein to produce browning or "tanning," has been observed from time to time (cf. Dreizen, Gilley, Mosny, and Spies, J. Dental Research, vol. 36, pages 233-36, 1957) and the tanning effect of dihydroxy acetone on the keratinized cells making up the stratum corneum of the skin, has been studied in years past.

With the advent of the fashionable year round suntan, solutions of dihydroxy acetone have been marketed commercially, to permit people to induce a simulated suntan effect by applying the solution to their skins.

Some of these commercial preparations are solutions in a water-alcohol mixture, to which perfume has been added. These preparations are not entirely satisfactory. The alcoholic solution tends to dry the skin and is difficult to apply uniformly. The user cannot readily control the amount applied in any one area, nor can the user determine whether a certain area, for example, on the shoulders or the legs, has been previously covered. This results in either over- or under-application, which produces unevenness of the browning color, in the form of streaks or blotches.

In an effort to avoid these problems, cosmetic manufacturers have sought to make a formulation in a creamy base, which term is used herein to embrace compositions of the consistency and physical character of the usual types of hand and face lotions, vanishing creams and cold creams. Such creamy base formulations of dihydroxy acetone have been marketed; however, these products have proved to have a very short shelf life, turning yellow, and losing their ability to produce a cosmetic tan on the skin. This deterioration is readily apparent within six months of the compounding of these creamy base compositions.

One of the objects of this invention is to provide a creamy base cosmetic preparation, containing an effective amount of dihydroxy acetone to produce tanning of the human skin, which is stable both as to color and to the effectiveness of the dihydroxy acetone.

Another object of this invention is to provide such a creamy base lotion which contains a sunscreensing agent.

Still other objects will become apparent to those skilled in the art in the light of the following disclosure.

In accordance with this invention, generally stated, a cosmetic preparation is provided which contains a non-toxic, acid-stable, creamy base and a cosmetically effective amount of dihydroxy acetone. The preparation has a pH upon compounding and upon six months or more aging, between 2.5 and 6.0. A part, but a very useful and desirable part of this invention, is the incorporation, in the creamy base preparation, of a sunscreensing agent free of amino groups.

It is highly desirable to combine sunscreensing agents

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with the simulated suntanning preparation, so that, if it is at all possible for the user to do so, the user can apply the preparation, and shortly thereafter get into the sunlight as he normally would in the use of a so-called suntan lotion. Under such circumstances, the user will acquire a more lasting and deep-colored tan than with either the suntan lotion or simulated suntan lotion alone, but, at the same time, the uniformity will not be so great as to appear artificial. That is to say, the user will acquire the attractive highlights of a natural tan. It has been found, however, that sunscreensing agents now commonly used in suntan lotions react with dihydroxy acetone or, at least, in its presence, to develop a yellow to brown color. We have discovered, that by using sunscreensing agents, such as salicylates and cinnamates, free of amino groups, in a creamy base containing dihydroxy acetone, and maintaining the pH of the product between 2.5 and 6.0, a cosmetic product is produced which is stable both as to color and as to the effectiveness, as a skin tanning agent, of the dihydroxy acetone.

The following examples are merely illustrative of creamy base products of this invention.

### Example 1

Part I:	Percent
Polyethylene glycol ether-fatty alcohol complex -----	3.5
Lanolin -----	1
Methyl polysiloxane -----	0.2
Cetyl alcohol -----	2.0
Part II:	
Methylparaben -----	0.2
Propylene glycol -----	3.0
Water -----	66.0
Part III:	
Dihydroxy acetone -----	0.5-2.0
Water -----	10.0
Part IV:	
Perfume -----	0.1
Citric acid -----	0.025
Water, q.s. to 100%.	

pH—initially and upon aging does not exceed 5.5.

The components of Part I are combined and heated to 175° F. in a steam-jacketed kettle. In a separate kettle, the ingredients of Part II are combined and heated to 175° F. The mixture of Part I is then added to the mixture of Part II, with continuous stirring.

The dihydroxy acetone is dissolved in the water, Part III, and added to the mixture of Parts I and II with continuous stirring. The mixture is allowed to cool.

When the temperature of the mixture drops to 120° F., the citric acid, dissolved in a small amount of water, and the perfume, Part IV, are added. Stirring is continued until the lotion reaches room temperature.

The volume is adjusted by the addition of water, and the resultant lotion is mixed well.

### Example 2

	Percent
Carboxypolymethylene (Carbopol 940, Goodrich Chem. Co.) -----	1.5
Polyethylene glycol 600 -----	5
Dihydroxyacetone -----	0.5-2.0
Diisopropanolamine, q.s. ad -----	1
Perfume, q.s.	
Water, q.s. to 100%.	

pH—initially and upon aging does not exceed 5.5.

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All of the ingredients, except the diisopropanolamine, are placed in a homogenizer and mixed until a uniform, homogeneous mixture is achieved.

The diisopropanolamine is then added and mixed only enough to incorporate it thoroughly. The pH of the mixture, during the addition of the diisopropanolamine should be checked, to insure that the pH does not rise above 5.5.

*Example 3*

Part I:	Percent	10
Polyethylene glycol ether-fatty alcohol complex -----	3	
Polyoxyethylene sorbitan stearate -----	2.5	
Sorbitan sesquioleate -----	3	
Methyl polysiloxane -----	0.2	15
Lanolin -----	1	
Cetyl alcohol -----	1	
Homomenthyl salicylate -----	6-12	
Part II:		20
Methylparaben -----	0.2	
Propylene glycol -----	3.0	
Water -----	60.0	
Part III:		25
Dihydroxy acetone -----	0.5-20	
Water -----	10.0	
Part IV:		30
Perfume -----	0.2	
Citric acid -----	0.025	
Water, q.s. to 100%.		

pH—initially and upon aging does not exceed 5.5.

The components of Part I are combined and heated to 175° F. in a steam-jacketed kettle. In a separate kettle, the ingredients of Part II are combined and heated to 175° F. The combined components of Part I are then added to the combined components of Part II, with continuous stirring.

The dihydroxy acetone is dissolved in the water, Part III, and added to the combined Parts I and II, with continuous stirring. The mixture is then allowed to cool.

When the temperature of the mixture has reached 120° F., the citric acid, dissolved in a small amount of water and perfume, Part IV, are added.

The volume is adjusted by the addition of water, and the resultant lotion is mixed well.

*Example 4*

Part I:	Percent	50
Polyethylene glycol ether-fatty alcohol complex -----	3	
Polyoxyethylene sorbitan stearate -----	2.5	
Sorbitan sesquioleate -----	3	
Methyl polysiloxane -----	0.2	55
Lanolin -----	1	
Cetyl alcohol -----	1	
2-ethoxy ethyl p-methoxy cinnamic acid -----	0.5-6	
Part II:		60
Methylparaben -----	0.2	
Propylene glycol -----	3.0	
Water -----	60.0	
Part III:		65
Dihydroxy acetone -----	0.5-20	
Water -----	10.0	
Part IV:		70
Perfume -----	0.2	
Citric acid -----	0.025	
Water, q.s. to 100%.		

pH—Initially and upon aging does not exceed 5.5.

The manufacturing procedure for the lotion of Example 4 is precisely the same as for that of Example 3.

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*Example 5*

Part I:	Percent
Polyethylene glycol ether-fatty alcohol complex -----	12
Lanolin -----	3
Cetyl alcohol -----	3
Methyl polysiloxane -----	1
Part II:	
Propylene glycol -----	5
Methylparaben -----	0.15
Propylparaben -----	0.05
Dihydroxy acetone -----	0.5-20
Citric acid -----	0.025
Water, q.s. to 99.8%.	
Part III:	
Perfume -----	0.2

The ingredients of Part I and Part II are mixed separately, and each mixture is heated to 180° F. The mixture of Part II, is then added to the mixture of Part I, with stirring. The heating is discontinued, and stirring is continued until the temperature reaches 120° F., at which point the perfume is added. The mixture is stirred until cooled to room temperature.

The pH initially upon compounding, and upon aging, does not exceed 5.5. If the pH should rise above 5.5 in the compounding, additional citric acid is added to reduce the pH below 5.5.

The product of Example 5 is of the consistency in physical character of what is known in the trade as a cream, as compared with the product of Examples 3 and 4, which is of the character known as a lotion in the trade.

*Example 6*

Another example of a product of this invention, in the form of a cream, is as follows:

Part I:	Percent
Polyethylene glycol ether-fatty alcohol complex -----	12
Lanolin -----	3
Cetyl alcohol -----	3
Methyl polysiloxane -----	1
Homomenthylsalicylate -----	6-12
Part II:	
Propylene glycol -----	5
Methylparaben -----	0.15
Propylparaben -----	0.05
Dihydroxy acetone -----	0.5-20
Citric acid -----	0.025
Water, q.s. to 99.8%.	
Part III:	
Perfume -----	0.2

The compounding of the product of Example 6 is identical with that of Example 5.

While the preferred pH is around 4.0 to 4.5, the pH of 5.5 indicated by the examples gives some leeway against the upper limit. The operative range of pH for producing stable products extends from about 2.5 to about 6.0.

It will be observed that reference has been made in the specification and claims to a six month aging period. This is an arbitrary length of time, but ample to establish the stability of the product. The creamy base preparations, not made in accordance with this invention, on the market presently, exhibit deterioration within a matter of a few weeks. Products made in accordance with this invention appear to be stable over an indefinite period, having exhibited no deterioration either colorwise or tanning-effectivenesswise after more than six months.

The chief factors in the present invention appear to be the acid-stable creamy base at a low pH, and the absence, in the sunscreensing agent, of amino groups. It may be noted that in the composition of Example 2, diisopropanolamine is used, in the compounding of the creamy base. However, it is to be observed that less

than an equivalent amount of diisopropanolamine is reacted with the carboxypolymethylene, so that the composition not only remains on the acid side, but the amine is totally reacted.

Since the fatty acids, gel forming materials, organic acid buffers, wetting and dispersing agents, and even sun-screening agents need only meet the requirements that they be acid-stable, unreactive with dihydroxy acetone, free of active amino groups in the final composition, and non-toxic, numerous suitable materials for the compounding of such creamy bases, in addition to those specifically enumerated, will occur to those skilled in the art. Thus, for example, as acid buffers, tartrates, phosphates, acetates, and the like may be substituted for the citric acid or citrates given in the examples. For fatty acids, gel forming agents, wetting agents and the like, acid stabilized glyceryl monostearate, propylene glycol stearate, modified lanolin derivatives, gums, polyoxyethylene derivatives, and sorbitan derivatives, for example, can be employed.

Sunscreens owe their value in suntan products to their ability to absorb ultraviolet light in the range of 2900-3250 Angstrom units. This is the region of the sun's radiation which causes the undesirable and potentially harmful burning when it strikes the unprotected skin. By filtering out this portion of the radiation, it becomes possible to enjoy sunbathing and acquire a tan in comfort and safety. Sunscreening agents other than salicylates or cinnamates may be used, so long as they do not contain amino groups. Examples of sunscreening agents which do contain amino groups and which, accordingly, are unsatisfactory, are esters of para-amino benzoic acid, such as glyceryl para-amino benzoate, and esters of anthranilic acid.

The amounts of the various constituents may also be varied, so long as the product contains an effective amount of dihydroxy acetone, and, in those products in which the sunscreening agent is used, an effective amount of sunscreening agent. Similarly, other kinds and other amounts of emollient, viscosity-modifying, preservative and perfuming agents and the like, such as are conventionally used in cosmetic creams and lotions, may be included in the formulations, provided they are not harmful for use on human skin and are not conducive to developing pH changes of the final product outside the range of stability, 2.5 to 6.0.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. A cosmetic preparation comprising a non-toxic, stable, creamy base, a cosmetically effective amount of dihydroxy acetone, and an effective amount of sunscreening agent characterized in being free from active amino groups, unreactive with dihydroxy acetone, and non-toxic, said preparation having a pH upon compounding and upon six months' aging, of between 2.5 and 6.0.

2. The preparation of claim 1 wherein the sunscreening agent is selected from the group consisting of homomenthyl salicylate and 2-ethoxy ethyl p-methoxy cinnamic acid.

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