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PROCESS AND COMPOSITION FOR EXAMINING EYES WITH FLUORESCENT VITAMIN B_2

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This invention relates to a method of examining eyes and particularly relates to a method of examining eyes utilizing a fluorescent substance under the influence of incandescent light source equipped with a suitable filter.

It has heretofore been universal practice in the examination of eyes to use fluorescein sodium (resorcinol phthalein) under selected wave lengths of ultraviolet light for the delineation of cuts or abrasions, for the location of foreign bodies and for the filling of contact lenses. Although this compound gives reasonably satisfactory results, it is not considered fully satisfactory for all purposes. For one thing, fluorescein sodium is a synthetic aromatic chemical and such chemicals are under suspicion as being carcinogenic. Further, fluorescein sodium is somewhat limited in its activity and normally must be used in a well-darkened room with ultraviolet light passing through an efficient filter. Another drawback is that fluorescein stains human skin, as well as fabrics, and is difficult to remove. Further, fluorescein solutions are useless when fitting tinted contact lenses.

Accordingly, one object of the present invention is to provide a method of eye examination and fluorescent solution using a naturally-occurring component of all animal bodies and which is tolerant of the presence of visible light.

According to another object of this invention, a buffered fluorescent solution is provided which is substantially non-irritating.

A further object of the invention is to provide a fluorescent solution which has little, if any, staining effect on human skin or clothing.

Another object of the invention is to provide a solution suitable for use when fitting tinted contact lenses.

Other objects and features of advantage will be apparent from the balance of the specification.

According to the present invention, a solution of vitamin B_2 (riboflavin) or preferably a derivative thereof, such as riboflavin 5'-phosphate sodium or riboflavin 5'-phosphate monodiethanolamine, is instilled into the eye and then the eye examination, such as a search for a foreign body or the fitting of contact lenses, can proceed under an incandescent light source equipped with a proper filter and the vitamin B_2 will fluoresce and delineate any irregularities.

Although vitamin B_2 as such can be used, it is sparingly soluble in water and it is normally preferred to use vitamin B_2 phosphate sodium. The monodiethanolamine salt may be used also. The concentration of the vitamin B_2 compound is not critical and can vary from 0.01% up to the solubility limit of the particular compound employed. It is normally preferred to employ a solution containing about 2.0% of the vitamin B_2 compound.

The solution employed may consist merely of vitamin B_2 or a derivative dissolved in water, but it is normally preferred to render it approximately isotonic by means well known to those skilled in the art. It is also preferred to employ a buffering agent and to adjust the pH to substantially neutral, i.e. about pH 7, although the pH can vary from about 6.8 to 8.

Other agents may be added such as a preservative. It is not necessary to add the preservative but it is desirable in many instances, particularly when the solution is packaged in a form suitable for a number of treatments. The

preservative is ordinarily not necessary when packaged in single dosage containers. Suitable preservatives include phenylmercuric acetate, phenylmercuric nitrate, chlorobutanol, esters of parahydroxy benzoic acid, and the like.

In some instances it is also desirable to incorporate a chelating agent, such as a Versene (e.g. disodium ethylenediaminetetraacetate), particularly if heavy metals are present in the water which is used.

Although it has heretofore been known that riboflavin is fluorescent, it has not been recognized that it was useful in eye examinations. Many substances fluoresce, yet few possess the property of delineating irregularities in proteinaceous matter and the exact mechanism of such delineation is not understood.

The following non-limiting examples illustrate preferred methods of practicing the invention:

Example 1

The following solution was prepared (all parts by weight):

Riboflavin-5'-phosphate sodium	2.0
Boric acid	0.9
Sodium borate	0.5
De-ionized water to make	100.0.

A few drops of the solution were instilled in the eyes of a patient, and the eyes examined using a Burton lamp. There was a good delineation of the eye structure.

Example 2

The following solution was prepared (all parts by weight):

Riboflavin-5'-phosphate sodium	1.0
Disodium ethylenediaminetetraacetate	0.01
Sodium acid phosphate	0.24
Disodium phosphate	0.66
Chlorobutanol	0.5
Sodium chloride	0.25
De-ionized water to make	100.0.

A few drops of the solution were instilled in the eyes of a patient, and the eyes examined using a Slit lamp. There was a good delineation of the eye structure.

Similar results were obtained with the following formulations:

Example 3

Riboflavin-5'-phosphate sodium	4.0
Methyl parahydroxy benzoate	0.025
Propyl parahydroxy benzoate	0.015
Sodium chloride	.30
Sodium hydroxide	.175
De-ionized water to make	100.0.

Example 4

Riboflavin-5'-phosphate diethanolamide	2.5
Boric acid	0.9
Sodium borate	0.5
Disodium ethylenediaminetetraacetate	0.01
Phenyl mercuric nitrate	0.004
Water to make	100.0.

Example 5

Riboflavin	0.010
Nicotinamide	2.5
Sodium chloride	0.5
Phenyl mercuric acetate	0.004
De-ionized water to make	100.0.

Obviously, many modifications and variations of this invention may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. The process of examining eyes comprising: instilling in the eye an aqueous solution of a member selected from the group consisting of vitamin B_2 and water-soluble salts of vitamin B_2 and examining the eye under an incandescent source employing a suitable filter in the absence of sufficient visual light to obscure the fluorescent effect.

2. The process of claim 1 wherein the solution contains at least 0.01% of the vitamin B_2 compound.

3. The process of claim 1 wherein the solution contains about 2.0% of the vitamin B_2 compound.

4. A solution for the examination of eyes comprising an isotonic aqueous solution of a member selected from the group consisting of vitamin B_2 and water-soluble salts of vitamin B_2 wherein said solution contains at least 0.01% of said member.

5. The solution of claim 4 wherein the pH is adjusted to from about 6.8 to about 8.

6. The solution of claim 4 wherein a preservative is present.

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