The invention relates to a method for disinfecting and cleaning contact lenses for the human eye in which for an initial period a hydrogen peroxide solution is caused to act on the contact lens and then, for a second period, the hydrogen peroxide adhering to and/or absorbed by the contact lens is caused to split under the action of a catalyst into water and oxygen, and to a treatment liquid for the final cleaning of contact lenses that have been subjected to a hygiene treatment in a hydrogen peroxide solution.

When contact lenses are used they become contaminated and to avoid the risk of infection of the eye the accumulation of pathogenic germs must not exceed a critical limit. For this reason daily disinfection of contact lenses is necessary. This is especially so for hydrophilic soft lenses which are widely used today.

FR-AS 2 231 395 describes for this purpose a method in which hydrogen peroxide, which has, at the same time, an oxidising, germicidal, cleaning and odour-eliminating effect, is used. In this method the contact lenses are first subjected to the action of a 3 to 30 per cent solution of hydrogen peroxide; as described in GB-AS 1 531 035, this can be effected, for example, in a small container in which the contact lenses are arranged in a carrying basket. The time required for the hydrogen peroxide to act on the contact lenses to produce adequate disinfection and cleaning is approximately 20 minutes. The hydrogen peroxide adhering to the contact lenses then has to be removed; this is effected according to the known method by introducing the contact lenses into a second container containing a neutral liquid and a catalyst, in the presence of which the hydrogen peroxide is split into water and oxygen in accordance with the reaction equation

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$$2\ H_2O_2 \longrightarrow 2\ H_2O + O_2.$$

The catalyst is a metal-coated solid body.

The disadvantage of the known method is that the second method step, that is to say the removal of the hydrogen peroxide by splitting, takes a relatively long time. At least 4 hours are required for this. If the contact lens user forgets, for example, to transfer the contact lenses from the hydrogen peroxide solution to the solution containing the catalyst in the evening, then the following morning there is not enough time to remove enough of the hydrogen peroxide residues from the contact lenses to prevent burning of the eyes when the lenses are being worn. In accordance with a modification of the known method, which can likewise be found in FR-AS 2 231 395, the metallic catalyst is added to the hydrogen peroxide solution at the moment when the hydrogen peroxide solution is caused to act on the contact lenses. The disinfection and cleaning of the contact lenses and the decomposition of the hydrogen peroxide by the catalyst thus begin at the same time. This is possible with this known method because the decomposition triggered by the catalyst takes place slowly. This one-step method also has the considerable disadvantage of taking a very long time (several hours). Furthermore, in this known method a final rinse in saline solution is provided to remove any remaining hydrogen peroxide residues.

It is known from the article "Disinfection of Hydrophilic Contact Lenses with Commercial Preparations of 3 % and 6 % Hydrogen Peroxide" by W.L. Levine et al., Dev. Ind. Microbiol. 22, 813 (1981), that contact lenses can be disinfected with hydrogen peroxide. In this study, after disinfection with hydrogen peroxide contaminated lenses are introduced into a culture medium in order to

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determine from the subsequent growth of bacteria whether, and if so how many, bacteria have survived the hydrogen peroxide treatment. Since the presence of hydrogen peroxide in the culture medium hinders the growth of bacteria and therefore would produce false results for the rates of destruction by the hydrogen peroxide during the disinfection process, a small amount of catalase is added to the culture medium to decompose the peroxide that has been carried along. Catalase is mentioned here as a constituent of a culture medium and serves to make possible the growth of bacteria.

The problem on which the invention is based is further to develop the method mentioned at the beginning in such a manner that the time required for the second step of the method is substantially reduced and at the same time very high-grade removal of hydrogen peroxide is achieved.

To solve this problem a method is proposed according to the invention which is characterised in that after the end of the initial period the hydrogen peroxide solution surrounding the contact lens is replaced by a saline solution corresponding in concentration to eye fluid and containing catalase.

In accordance with an advantageous development of the invention there is used as the saline solution containing catalase a mixture of at least from 100 to 1000, preferably from 400 to 600, parts by volume of an approximately 0.8 to 1.0 % saline solution and one part by volume of a commercially available highly concentrated catalase solution. Claims 3 and 4 describe the composition of the treatment liquid for carrying out the method according to the invention.

Catalase is an enzyme which is preferably obtained

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from beef liver and has a crystalline structure. It is obtainable commercially in the form of a highly concentrated solution dissolved in 30 % glycerin and 10 % ethanol and is used in the food industry, especially in the treatment of milk, as described, for example, in US-A 3 282 702.

The problem per se with using organic catalase is that it is not very stable and is difficult to keep. The commercially available highly concentrated catalase solution mentioned above has to be stored at 4°C and even then keeps for only a few months.

The invention is based on the recognition that the removal of hydrogen peroxide residues from contact lenses is substantially faster and more thorough in the presence of catalase as a catalyst than when the known catalysts are used, that when the catalase is used in the isotonic saline solution it is found, surprisingly, to keep for a very long time and not to be very susceptible to temperature, and that the lenses can be inserted into the eye immediately after the treatment, without further rinsing. All this makes the method according to the invention extremely suitable for practical application.

In the method according to the invention the time required for the second portion of the method is only a few minutes (approximately 5 minutes). With the method according to the invention, therefore, it is not important if the contact lens user forgets to initiate the second step at night, since only a few minutes are required the next morning to take care of it. The very turbulent decomposition of the hydrogen peroxide not only considerably shortens the time required, however; there is also an explosion-like decomposition of the hydrogen peroxide at the surface of the contact lens which forces

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off the contamination on the surface of the contact lenses that has been broken up during the first step of the method. The removal of the hydrogen peroxide residues by the method according to the invention is so thorough that subsequent after-treatment (rinsing) of the lenses in a saline solution can be omitted.

When carrying out the second step of the method, that is to say the catalytic decomposition of the hydrogen peroxide, it is best to use as the liquid which replaces the hydrogen peroxide solution in the container the above-mentioned liquid consisting of highly concentrated catalase preserved in saline solution. It is also possible to work with two containers, the hydrogen peroxide solution in one container and the catalase-containing saline solution, which has a concentration that corresponds to the concentration of eye fluid, that is to say is isotonic, in the other.

The concentration in which the catalase in its commercially available form is added to the carrier liquid, for example hydrogen peroxide solution or saline solution, can vary within wide limits of approximately from 0.1 to 1 per cent by volume.

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Patent claims

1. Method for the disinfection and cleaning of contact lenses for the human eye, in which method during an initial period a hydrogen peroxide solution is caused to act on the contact lens and then, during a second period, the hydrogen peroxide adhering to and/or absorbed by the contact lens is split under the action of a catalyst into water and oxygen, characterised in that after the end of the initial period the hydrogen peroxide solution surrounding the contact lens is replaced by a saline solution corresponding in concentration to eye fluid and containing catalase.

2. Method according to claim 1, characterised in that as the saline solution containing catalase a mixture of at least from 100 to 1000 parts by volume of an approximately 0.8 to 1.0 % saline solution and one part by volume of a commercially available highly concentrated catalase solution is used.

3. Treatment liquid for the final cleaning of contact lenses which have been subjected to a hygiene treatment in a hydrogen peroxide solution, characterised in that it contains catalase in a saline solution corresponding in concentration to eye fluid.

4. Treatment liquid according to claim 3, characterised in that it consists of a mixture of at least from 100 to 1000 parts by volume of an approximately 0.8 to 1.0 % saline solution and one part by volume of a commercially available highly concentrated catalase solution.

5. Treatment liquid according to claim 3 or 4, characterised in that the catalase is dissolved in glycerin and ethanol.

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