EYEDROPS

The invention relates to a novel type of isotonic ophthalmic preparations. These are especially useful in the treatment of, and in alleviation of the symptoms of dry eye syndrome. The main ingredient of such eye drops is a humectant. Suitable humectants include isotonic glycerine.

The isotonic solutions may be used as eye drops in cases of dry eye syndrome; they may also be used as carriers for pharmaceutically active ingredients.

Various eye diseases require treatment by the application of liquid preparations, administered to contact the eye. Eye drops are also frequently required by wearers of contact lenses. Dry eye disease is a serious condition which requires the repeated application of eye drops per day. Conventional eye drops are based on isotonic solutions of various inorganic salts, with or without "non-ionic" substances (see U.S. Patent 4,409,205), frequently with an added high-molecular weight substance which increases the viscosity of the drops. Amongst frequently used polymeric substances there may be mentioned methyl cellulose, hydroxy ethyl cellulose, polyvinyl alcohol, polyvinylpyrrolidone, hyaluronic acid and the like. The viscosity is generally 1 cp to 30 cp. The isotonic solutions containing inorganic salts have certain drawbacks related to their physiological and viscosity performance, especially when used continuously for a prolonged period of time. The present invention overcomes such drawbacks.

The present invention consists in eye drops consisting of an essentially isotonic solution of a physiologically acceptable non-ionic organic humectant, an anionic-type viscosity enhancing agent not exceeding 0.1% by weight, in combination with required preserving agents, the drops containing less than 1.5 millimol/liter of salt, other than salts of said anionic-type viscosity enhancing agents.

There are thus provided isotonic eye drops for the

treatment of, and for the alleviation of the symptoms of, dry eye syndrome. The eye drops of the invention have advantageous properties as compared with conventional eye drops. These drops can be used as such for the treatment of dry eye diseases. They can also be used as carrier for various types of medications used in ophthalmology. They can be used, amongst others, as carriers for various antimicrobial agents (antifungal agents, antibiotics, antiviral agents and the like) for antiglaucoma agents or for anti-inflammatory agents. A preferred humectant is glycerol. Other substances used according to the present invention are by themselves humectants, i.e. they are capable of holding water.

The ophthalmic preparations according to the invention include preserving agents so as to prevent their deterioration on storage. These are well known in the art and not indicated in the specific examples. The viscosity increasing agents are generally high molecular weight compounds which are physiologically acceptable. The viscosity is preferably adjusted to a value in the range of 1 cp to 30 cp, the preferred range being 3 cp to 20 cp. Especially advantageous results were obtained by the use of hyaluronic acid, polyacrylic acid, either by itself or in combination with other physiologically acceptable high molecular weight substances.

The eye drops are based on physiologically acceptable humectants. Humectants of choice are glycerol, sorbitol and other acceptable humectant polyols. These are organic non-ionic substances and very good results were obtained by the use of these.

The humectants are always used in the form of an essentially isotonic solution. The eye drops are sterilized and, if required, suitable agents are added to prevent bacterial or fungal deterioration.

There were tested solutions of this type for treating dry eye disease. There were also prepared

ophthalmic preparations comprising antimicrobials and antiviral agents wherein the carrier was an isotonic solution defined above.

The invention will be further illustrated with reference to the following examples, which are of an illustrative nature only, and which are of a non-limitative nature.

Example 1: Isotonic Ophthalmic Solution:

A solution was prepared containing :

Glycerol		2.75 g
Sodium hyaluronate		0.05 g
Water	up to	100 ml

Example 2: Isotonic Ophthalmic Solution:

An isotonic solution was prepared containing :

Glycerol		2.75 %
Carbomer		0.03 %
Water		100 ml

Example 3: Isotonic Ophthalmic Antiviral Solution:

To 100 ml of the solution of Examples 1 or 2, there was added: 0.1 g Idoxuridine

Example 4: Isotonic Antiglaucoma Solution:

To 100 ml of the solution of Examples 1 or 2, there was added: 2 g pilocarpine

Example 5: Isotonic Ophthalmic Antibacterial Preparation:

To 100 ml of the solution of Examples 1 or 2, there was added: 0.5 g chloramphenicol

Example 6: Anti-inflammatory Ophthalmic Solution:

To 100 ml of a solution of Examples 1 or 2, there was added: 0.05 g dexamethasone sodium phosphate

In all the examples, the solution was adjusted to isotonicity and to a pH of 7.

Suitable conventional stabilizers and preservatives were added.

A group of 20 patients suffering from dry eye syndrome was treated with the ophthalmic solution of Example 1.

With conventional preparations they required more than four applications of eye drops per day. Using the composition of Example 1, only two daily applications were needed.

Eye drops containing an anti-inflammatory solution as set out in Example 6 were used for the treatment of inflammations of the eye. The drops were well tolerated and good results were obtained without any irritation of the eyes.

Relief was very rapid.

The humectant properties of the preparations of the present invention are easily demonstrated by applying isotonic solution of the invention to the skin of the forearm and by measuring the electrical conductivity, or capacitance of the stratum corneum resulting within half an hour after such application. An increase of such conductivity or capacitance is indicative of a humectant effect.

CLAIMS:

1. Eye drops consisting of an essentially isotonic solution of a physiologically acceptable nonionic organic humectant, an anionic-type viscosity enhancing agent not exceeding 0.1% by weight, in combination with required preserving agents, the drops containing less than 1.5 millimol/liter of salt, other than salts of said anionic-type viscosity enhancing agents.

2. Preparation according to claim 1, wherein the humectant is selected from glycerol or other non-polymeric humectant polyols.

3. Preparations according to claim 1 or 2, wherein the viscosity enhancing agent is hyaluronic acid, polyacrylic acid or a carbomer.

4. Preparations according to any of claims 1 to 3, containing also an effective quantity of an antibacterial agent, of an antiviral agent, of an antifungal agent, of an antiglaucoma agent or an anti-inflammatory agent.

5. Preparations according to any of claims 1 to 3, for the treatment of, and alleviation of symptoms of, dry eye syndrome.

6. Eye drops having a viscosity of less than 30 cp at a shear rate greater than 100 sec^{-1}.

7. Eye drops according to claim 1, substantially as herein described with reference to any one of the Examples.

8. Eye drops according to claim 6, substantially as herein described with reference to any one of the Examples.