Additives that could interfere with the sealing of a cover onto a contact lens package are delivered separately from the bulk saline delivered into the lens package, thereby allowing more precise control of the additive delivery, reducing the incidence of additive in the seal area of the lens package, and improving the seal integrity.
ADDITIVE SALINE DOSING SYSTEM AND METHOD
FOR CONTACT LENS PACKAGING

BACKGROUND OF THE INVENTION

Technical Field

[0001] The present invention relates generally to the packaging of ophthalmic contact lenses and, more specifically, to promoting good sealing of the contact lens package.

Description of the Related Art

[0002] Hydrophilic ophthalmic contact lenses are commonly packaged in individual primary containment packages, generally known as "blister packages" or "blister packs." As shown in Fig. 1, a blister package 10 generally consists of a plastic (e.g., polypropylene) shell 12 having a concave or bowl-shaped depression or cavity 14 in which a lens (not shown) is disposed immersed in a sterile aqueous (saline) solution and sealed with a laminate foil cover 16. A flat rim 18 surrounds the cavity 14. (Shells 12 may include additional features to aid use and handling of the blister package 10, but they are not shown for purposes of clarity.) As illustrated in Fig. 2, blister packages 10 are generally manufactured in strips comprising a number, such as five, of adjoining blister packages 10 that a user can easily separate by snapping them apart from one another. Such packaging keeps the lens in a hydrated and sterile state before being opened and worn by a user. Often, a lens is contained within a blister package for a significant amount of time while the lens is being shipped and held in storage before use. Therefore, it is important that the saline solution be hermetically sealed therein, to ensure that the solution cannot leak out and to prevent contaminants from entering the lens containment area.

[0003] The stations of a conventional contact lens packaging line are illustrated generally in Fig. 3. Strips of the shells 12 (e.g., five shells) are carried in carrier trays (not shown), which are moved from one station to the next by a conveyor 19. For purposes of clarity, however, the packaging process is described herein with respect to only a single lens and its package. At station 20, a contact lens (not shown) is placed into a shell cavity 14 (Figs. 1-2). Shell 12 is then conveyed to a station 22 which fills cavity 14 with an amount of saline solution sufficient to ensure the lens is immersed.
The saline solution contains, in addition to water and sodium chloride, one or more additives, such as buffers and lubricating agents. The filled shell 12 is then conveyed to a station 24 that uses ultrasonic vibration to remove any bubbles in the solution, as such bubbles could interfere with optical inspection of the lenses at the next station 26. At station 26, the lens is optically inspected by imaging the lens using a camera and image-processing equipment (not shown). The shell is then conveyed to a station 28 that places a foil cover 16 on it. Shell 12 then arrives at a station 30 that seals foil cover 16 to rim 18. In one conventional method of sealing foil cover 16, a heating element or heated seal plate presses foil cover 16 against rim 18 to heat-seal cover 16 to shell 12 to form the completed blister package 10.

[0004] Undesirable conditions during sealing can sometimes give rise to a poor, i.e., non-hermetic, seal between foil cover 16 and the shell 12. For example, saline droplets can sometimes undesirably splash upon rim 18 during the step of the packaging process (e.g., station 22) at which cavity 14 is filled with saline solution. When shell 12 is subsequently sealed with foil cover 16 (e.g., at station 30), such droplets can create wrinkles in foil cover 16 and/or otherwise prevent foil cover 16 from properly adhering to shell 12, giving rise to undesired channels or pathways between foil cover 16 and cavity 14 that can permit the saline solution to leak out or contaminants to infiltrate cavity 14 and contaminate the lens. Saline solutions having certain additives included therein have been found to interfere with proper sealing to a significantly greater extent than would pure saline without those additives, when present in the sealing area.

[0005] Accordingly, needs exist for improvements to contact lens packaging systems that promote good, i.e., hermetic, seals between the cover and plastic shell of a blister package. The present invention is directed to these needs and others in the manner described below.
SUMMARY

[0006] The present invention relates to a system and method for delivering or dosing at least one additive, such as a buffer or lubricant, into a contact lens package separately from the bulk dispensing of saline without said additive(s) into the lens package. For example, the saline is delivered at a dispensing station into the lens package, and the one or more additives are separately delivered at a dosing station. The quantity of additive dosed into the lens package is substantially less than the quantity of saline dispensed into the lens package, thereby permitting more precise and controlled dosing of the additive, and/or permitting dosing of the additive at a substantially lower flow-rate than the saline. After the package has been filled in this manner, it can be sealed with a cover in any conventional manner. The separate, controlled dosing of additive greatly reduces the likelihood of splashing the additive, or solution containing the additive, onto the rim of the lens package where it could interfere with proper sealing of the cover.

[0007] In an exemplary embodiment of the invention, a contact lens package is delivered to a dispensing station where saline solution not containing a specified additive is introduced into the lens package. The contact lens package is then delivered to a dosing station where at least one additive including the specified additive is introduced into the saline previously delivered into the lens package. A conventional conveyor system or similar device can be used to move the contact lens packages from station to station in essentially the same manner in which such a system moves such packages in a conventional contact lens packaging line. In alternate embodiments, the additive is dosed into the lens package prior to dispensing the saline into the lens package; and in still other embodiments, the additive and the saline are simultaneously delivered into the lens package via separate delivery mechanisms.

[0008] In another aspect, the invention is a method of packaging a contact lens, the method including depositing a contact lens into a container, the container defining a lens-receiving cavity and a sealing surface surrounding the lens-receiving cavity. The method further includes dispensing saline solution into the lens-receiving cavity at a first delivery rate, and dosing at least one additive into the lens-receiving cavity separately from the saline solution at a second delivery rate substantially less than the first delivery rate. Delivery of the at least one additive is controlled to prevent depositing additive on
the sealing surface surrounding the lens-receiving cavity. The method further includes applying a cover over the lens-receiving cavity in sealing engagement with the sealing surface.

[0009] In still another aspect, the invention is a method for dosing saline solution with an additive during contact lens packaging. The method includes introducing saline solution not containing a specified additive into a contact lens package, and separately introducing the specified additive into the contact lens package to combine the specified additive with the saline solution in the contact lens package.

[00010] In yet another aspect, the invention is a system for packaging contact lenses, the system including a conveyor for moving contact lens packages along a contact lens packaging line, a lens delivery station for placement of contact lenses in the contact lens packages, and a saline dispensing station for delivering saline solution not having a specified additive therein into the contact lens packages. The system also includes an additive dressing station for delivering the specified additive into the contact lens packages separately from the saline solution, without depositing the specified additive onto a seal area of the contact lens packages. The system also includes a sealing station for hermetically sealing a cover onto the seal area of each of the contact lens packages.

[00011] In another aspect, the invention is a contact lens product including a primary lens containment package incorporating a shell defining a lens-receiving cavity, and a cover for placement over the lens-receiving cavity. The product further includes a contact lens removably disposed within the lens-receiving cavity, a quantity of saline solution disposed within the lens-receiving cavity, and a quantity of an additive dosed into the lens-receiving cavity separately from the saline solution. The cover is hermetically sealed to the shell without interruption by any of the additive being deposited between the shell and the cover.

[00012] These and other aspects, features and advantages of the invention will be understood with reference to the drawing figures and detailed description herein, and will be realized by means of the various elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following brief description of the drawings and detailed description of
embodiments of the invention are exemplary and explanatory only, and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[00013] Figure 1 is a side elevation view of a blister pack, in accordance with known art, showing the foil cover over the rim of the shell.

[00014] Figure 2 is a top view of a strip of blister pack shells, in accordance with known art.

[00015] Figure 3 illustrates a plurality of stations of a contact lens packaging line, in accordance with known art.

[00016] Figure 4 illustrates a plurality of stations of a contact lens packaging line, in accordance with an exemplary embodiment of the present invention.

[00017] Figure 5 illustrates in further detail the saline dispensing station of the contact lens packaging line of Fig. 4.

[00018] Figure 6 illustrates in further detail the additive dosing station of the contact lens packaging line of Fig. 4.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[00019] The present invention may be understood more readily by reference to the following detailed description of the invention taken in connection with the accompanying drawing figures, which form a part of this disclosure. It is to be understood that this invention is not limited to the specific devices, methods, conditions or parameters described and/or shown herein, and that the terminology used herein is for the purpose of describing particular embodiments by way of example only and is not intended to be limiting of the claimed invention.

[00020] Also, as used in this specification ("herein") including the appended claims, the singular forms "a," "an," and "the" include the plural, and reference to a particular numerical value includes at least that particular value, unless the context clearly dictates otherwise. Ranges may be expressed herein as from "about" or "approximately" one particular value and/or to "about" or "approximately" another particular value. When such a range is expressed, another embodiment includes from the one particular value
and/or to the other particular value. Similarly, when values are expressed as approximations, by use of the antecedent "about," it will be understood that the particular value forms another embodiment. With regard to specific combinations of elements described herein, such elements can alternatively be combined in any other suitable manner with each other or with still other elements, and some elements can be omitted, or portions of the elements combined together with portions of other elements to form elements that differ from those specifically described. With regard to specific method steps described herein, unless otherwise stated, the steps can alternatively be performed in sequences other than those specifically described, and some steps can be omitted, or portions of the steps combined together to form steps that differ from those specifically described. Persons skilled in the art to which the invention relates will appreciate that the invention encompasses such alternatives.

[00021] The stations of a contact lens packaging line in accordance with an exemplary embodiment of the present invention are illustrated generally in Fig. 4. A conveyor system 32 moves the contact lens shells 12 (Fig. 1) in carrier trays (not shown for purposes of clarity) from station to station. Conveyor system 32 can include various types of devices and is not limited to a single conveyor belt or other single device. The trays can be of conventional design and carry strips (Fig. 2) of shells 12 in the conventional manner. The packaging line can operate in a continuous or indexed manner, with successive shells 12 carried by conveyor system 32 arriving at the stations and successively undergoing the process steps or operations described herein. For purposes of clarity, however, the process is described herein with respect to only a single shell 12.

[00022] Conveyor system 32 delivers a shell 12 to a lens placement station 34. Station 34 places a contact lens (not shown) into the cavity of shell 12 in any conventional manner. Conveyor system 32 then delivers the shell 12 to a saline dispensing station 36. In alternate embodiments, the saline is dispensed into the shell prior to lens transfer. Station 36, shown in further detail in Fig. 5, fills the cavity of shell 12 with a metered amount of saline solution 38. Saline solution 38 preferably has no additives, i.e., it consists essentially of an aqueous sodium chloride solution; or includes additives that do not significantly interfere with sealing of the cover, but does not include one or more specified additives that may interfere with sealing and therefore are to be
separately dosed. Filling is controlled by a suitable metering controller 40 that can comprise any suitable combination and arrangement of pumps, valves, pipette droppers, or similar devices as known in the art. Controller 40 controls the flow or movement of saline solution 38 from a saline supply tank or reservoir 42 in which it is stored, to the cavity of shell 12, as shown in Fig. 5.

[00023] Conveyor system 32 subsequently delivers the shell 12 to an additive filling (or "dosing") station 44. Station 44, shown in further detail in Fig. 6, doses the cavity of shell 12 with a metered amount of one or more additives 46. The additive is typically provided in liquid form, but alternatively may be in solid, powdered, gel or other form. Dosing is controlled by a suitable metering controller 48 that can comprise any suitable combination and arrangement of pumps, valves, pipette droppers, dosing needles, or similar devices as known in the art. Controller 48 controls the flow or movement of additives 46 from an additive supply tank or reservoir 50 in which it is stored, to the cavity of shell 12, as shown in Fig. 6. As the amount of additives 46 introduced into the cavity of shell 12 is small relative to the amount of bulk saline dispensed into the shell (in some instances, for example, only a droplet or two of additive per lens package, typically less than about 50%, less than about 35%, less than about 25%, less than about 10%, less than about 5%, or less than about 1% the volume of the bulk saline), the introduction is more precisely controllable and therefore less likely to result in additive splashing on the rim of shell 12. In embodiments of the invention providing equal cycle time for the additive dosing operation(s) and the saline dispensing operation, the delivery rate of additive(s) is generally reduced in proportion to the additive-to-saline ratio. As a result, separate dosing of the additive(s) allows delivery at a lower and more controlled delivery flow-rate, without slowing down the overall packaging process. In alternate embodiments of the invention, two or more dosing stations are included for separate delivery of different additives, and/or a single dosing station delivers one or more different additives either separately or in combination with one another. Also, the present invention includes systems and methods wherein one or more dosing station(s) deliver additive(s) to a lens package before, after, and/or simultaneously with the separate delivery of bulk saline not including said additive(s) to the lens package. The saline and/or the additive(s) can be delivered into the lens package before, after, or along with the contact lens.
The conveyor system 32 optionally delivers the lens packaging shell 12 through further processing stations, as shown in broken lines in Fig. 4. As these stations are conventional and thus well-understood in the art, they are not described in detail herein. The processing stations optionally include a bubble-removal station 52 that uses ultrasonic vibration to remove any bubbles in the solution, as such bubbles could interfere with optical inspection of the lenses and/or the packages. The lens and/or the package is optionally inspected at an in-package inspection station 54 by imaging the lens using a camera and image-processing equipment (not shown). These and/or other optional additional processing stations may be positioned upstream and/or downstream from the dosing station 44.

Shell 12 is then conveyed to a cover placement station 56 that places foil laminate cover 16 (Fig. 1) on it. The covered shell 12 then arrives at a closure and sealing station 58 that seals the foil laminate cover 16 to the rim of shell 12 using a heated seal plate or other suitable means as known in the art. Improved seal integrity is provided as a result of the reduced likelihood that seal-interfering additives were present in the seal area on the rim of the shell 12 during the closure and sealing step of the packaging process.

While the invention has been described with reference to preferred and example embodiments, it will be understood by those skilled in the art that a variety of modifications, additions and deletions are within the scope of the invention, as defined by the following claims. With regard to the claims, no claim is intended to invoke the sixth paragraph of 35 U.S.C. Section 112 unless it includes the term "means for" followed by a participle.
What is Claimed is:

1. A method of packaging a contact lens, said method comprising:
   depositing a contact lens into a container, the container defining a lens-receiving cavity and a sealing surface surrounding the lens-receiving cavity;
   dispensing saline solution into the lens-receiving cavity, the saline solution being dispensed at a first delivery rate;
   dosing at least one additive into the lens-receiving cavity separately from the saline solution, the at least one additive being dosed at a second delivery rate substantially less than the first delivery rate, and controlled to prevent depositing the at least one additive on the sealing surface surrounding the lens-receiving cavity; and
   applying a cover over the lens-receiving cavity in sealing engagement with the sealing surface.

2. The method of Claim 1, wherein the at least one additive is delivered into the lens-receiving cavity after the saline solution is delivered into the lens-receiving cavity.

3. The method of Claim 1, wherein the at least one additive is delivered into the lens-receiving cavity before the saline solution is delivered into the lens-receiving cavity.

4. The method of Claim 1, wherein the at least one additive is delivered into the lens-receiving cavity while the saline solution is delivered into the lens-receiving cavity.

5. The method of Claim 1, wherein the at least one additive is delivered into the lens-receiving cavity after the contact lens is deposited therein.

6. The method of Claim 1, wherein the second delivery rate is no more than 50% of the first delivery rate.
7. The method of Claim 1, wherein the second delivery rate is no more than 25% of the first delivery rate.

8. The method of Claim 1, wherein the second delivery rate is no more than 5% of the first delivery rate.

9. A method for dosing saline solution with an additive during contact lens packaging, comprising:
   introducing saline solution into a contact lens package, the saline solution not containing a specified additive; and
   separately introducing the specified additive into the contact lens package to combine the specified additive with the saline solution in the contact lens package.

10. The method of Claim 9, further comprising depositing a contact lens into the contact lens package.

11. The method of Claim 10, wherein the specified additive is introduced after the contact lens is deposited into the contact lens package.

12. The method of Claim 9, wherein the saline solution is introduced into the contact lens package at a first station, and wherein the specified additive is introduced into the contact lens package at a second station.

13. The method of Claim 9, wherein the saline solution is introduced into the contact lens package before the specified additive.

14. The method of Claim 9, wherein the saline solution is introduced into the contact lens package after the specified additive.

15. The method of Claim 9, wherein the saline solution is introduced into the contact lens package simultaneously with the specified additive.
16. The method of Claim 9, wherein the saline solution is introduced at a first delivery rate, and the specified additive is introduced at a second delivery rate that is no more than 35% the first delivery rate.

17. The method of Claim 9, wherein the saline solution is introduced at a first delivery rate, and the specified additive is introduced at a second delivery rate that is no more than 10% the first delivery rate.

18. The method of Claim 9, wherein the saline solution is introduced at a first delivery rate, and the specified additive is introduced at a second delivery rate that is no more than 1% the first delivery rate.

19. The method of Claim 9, further comprising sealing a cover onto the contact lens package to hermetically seal the saline solution and the specified additive therein.

20. A system for packaging contact lenses, said system comprising:
   a conveyor for moving contact lens packages along a contact lens packaging line;
   a lens delivery station for placement of contact lenses in the contact lens packages;
   a saline dispensing station for delivering saline solution not having a specified additive therein into the contact lens packages;
   an additive dosing station for delivering the specified additive into the contact lens packages separately from the saline solution, without depositing the specified additive onto a seal area of the contact lens packages; and
   a sealing station for hermetically sealing a cover onto the seal area of each of the contact lens packages.

21. The system of Claim 20, further comprising an inspection station for inspecting the contact lenses in the contact lens packages.
22. The system of Claim 20, wherein the specified additive is dosed into the contact lens packages after the saline solution is dispensed into the contact lens packages.

23. The system of Claim 20, wherein the specified additive is dosed into the contact lens packages after the contact lenses are placed in the contact lens packages.

24. The system of Claim 20, wherein the saline dispensing station dispenses saline solution at a first delivery rate, and wherein the additive dosing station doses the specified additive at a second delivery rate that is no more than 10% the first delivery rate.

25. A contact lens product comprising:
   a primary lens containment package comprising a shell defining a lens-receiving cavity, and a cover for placement over the lens-receiving cavity;
   a contact lens removably disposed within the lens-receiving cavity;
   a quantity of saline solution disposed within the lens-receiving cavity;
   a quantity of an additive dosed into the lens-receiving cavity separately from the saline solution;
   wherein the cover is hermetically sealed to the shell without interruption by any of the additive being deposited between the shell and the cover.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both national classification and IPC:

B29D11/00 B65B25/00

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols):

B29D  B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched:

Electronic data base consulted during the international search (name of data base and, where practical, search terms used):

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>WO 2005/011966 A (PROVIS LTD [GB]); HAMILTON RONALD SHADE [GB]; MCFARLANE STEPHEN DONALD) 10 February 2005 (2005-02-10) page 22, line 11 - page 23, line 12; figures 7-13</td>
<td>1-25</td>
</tr>
<tr>
<td>A</td>
<td>EP 0 811 474 A (JOHNSON &amp; JOHNSON VISION CARE [US]) 10 December 1997 (1997-12-10) column 12, line 37 - column 14, line 45; figures</td>
<td>1-25</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

Date of the actual completion of the International search: 3 February 2009

Date of mailing of the international search report: 13/02/2009

Name and mailing address of the ISA:

European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

Authorized officer: Philippon, Daniel

Form PCT/ISA/210 (second sheet) (April 2005)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>EP 1 048 443 A (OCULAR SCIENCES INC [US]) 2 November 2000 (2000-11-02) column 8, lines 3-10; figures</td>
<td>1-25</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patents family member(s)</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>WO 2005011966 A</td>
<td>10-02-2005</td>
<td>NONE</td>
</tr>
<tr>
<td>EP 0811474 A</td>
<td>10-12-1997</td>
<td>AT 276091 T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 715097 B2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 1472597 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2197530 Al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69730648 Dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69730648 T2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 10010477 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SG 75113 Al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW 389724 B</td>
</tr>
<tr>
<td>EP 0824063 A</td>
<td>18-02-1998</td>
<td>AT 282520 T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 3416597 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2212913 Al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69731590 Dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69731590 T2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 10311965 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SG 77605 Al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW 383276 B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 692692 B2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 5200696 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2175308 Al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69605970 Dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69605970 T2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 4059935 B2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 9024914 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SG 79918 Al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW 380211 B</td>
</tr>
<tr>
<td>EP 1048443 A</td>
<td>02-11-2000</td>
<td>DE 60021948 Dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 60021948 T2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HK 1032561 Al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6432217 B1</td>
</tr>
</tbody>
</table>