(54) Title: TOOTH-WHITENING FLAT STRIP

(57) Abstract: A tooth-whitening flat strip comprises an extruded, stable, solid solution of polyisobutenes, an acrylate copolymer, and hydrogen peroxide, and, optionally, a polybutene, isopropyl myristate, flavorant and sweetener. The tooth-whitening flat strip may include an optional release liner. A consumer uses the tooth-whitening flat strip by removing it from its packaging, removing the release liner if present, and applying the tooth-whitening flat strip to the teeth.

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TOOTH-WHITENING FLAT STRIP

PRIORITY

FIELD OF THE INVENTION
[0002] The present invention relates to a single-layer non-dissolvable strip of material which includes tooth-whitening compounds and that which, when placed on human teeth, provides for the whitening of the teeth.

BACKGROUND
[0003] Tooth-whitening appliances, devices and methods have historically included trays into which bleaching or tooth-whitening compounds are placed and thereafter the tray is positioned around the teeth to be whitened. Tooth-whitening appliances, devices and methods have also included multi-layer adhesive strips which are coated with tooth-whitening compounds and which are adhered to the teeth to be whitened. Prior tooth-whitening appliances, devices and methods have also included dissolvable strips which are coated with tooth-whitening compounds and which eventually dissolve after having been placed on the teeth to be whitened. Other types of tooth-whitening appliances, devices and methods are known to those of ordinary skill in the art.

[0004] Each of the prior art tooth-whitening appliances, devices and methods possesses advantages and disadvantages. For example, some prior art trays require the user to mix the tooth whitening components and place them in the tray prior to applying the tray to the teeth. Some prior art tooth-whitening strips which include an adhesive layer can be difficult to apply to the teeth as the adhesive layer indiscriminately adheres to almost any surface it contacts. Also, tooth-whitening strips which have a separate layer of tooth-whitening compound may be subject to the tooth-whitening compound being rubbed off or adhering to surfaces other than the teeth. Furthermore, tooth-whitening strips which comprise layers can only be applied to the teeth with the tooth-whitening layer against the teeth. Thus, such
layered tooth-whitening strips are subject to misapplication such that the "wrong-side" of the strip is placed against the teeth.

[0005] There is a need for a tooth-whitening device and method wherein the tooth-whitening device is a strip comprising tooth-whitening compounds which are not coated on a substrate. There is a further need for a tooth-whitening device and method wherein the tooth-whitening device comes packaged ready to use and does not require a user to apply a tooth-whitening compound or an adhesive prior to use.

SUMMARY OF THE INVENTION

[0006] There is described herein below a substantially flat tooth-whitening strip, which does not include layers but which provides tooth-whitening compounds and adhesiveness to keep the tooth-whitening strip positioned on a wearer's teeth. Therefore, the tooth-whitening flat strip described herein does not include an adhesive layer or a tooth-whitening layer. Furthermore, the tooth-whitening flat strip described herein, which generally comprises two parallel flat sides and two parallel thin edges, may be applied to the teeth with either of the flat sides against the teeth. Accordingly, there is no "wrong-side" to the tooth-whitening flat strip described herein. It should be understood that the specific shape of the flat strip described herein can be altered to improve comfort and fit and so may not be just two parallel flat sides and two parallel thin edges. The tooth-whitening flat strip of the present invention can include cut-outs, angles or curves, for example.

[0007] There is further described herein a tooth-whitening flat strip which is an extruded form of a blend of polyisobutenes, hydrogen peroxide, a copolymer of acrylates/acyrylic acid, flavors, and/or sweeteners. The extrudate may further include isopropyl myristate as a dispersing aid and extender. The tooth-whitening flat strips further described and claimed herein may optionally include (poly)phosphates. The tooth-whitening flat strips provided for herein do not require an adhesive such as polyvinylpyrrolidone ("PVP"), although formulations of the present invention may incorporate PVP. Cross-linked PVP ("PVP-CLM"), may be substituted for the copolymer of acrylates/acyrlic acid. In certain circumstances it may be advisable to avoid the use of PVP as PVP has been associated with allergic reactions.
[0008] There is also provided herein a method for making a single-layer tooth-whitening flat strip. The method includes preparing solid polyisobutene polymers by cutting them to size, blending the cut polyisobutene polymers under heat and mechanical mixing, co-adding the blended cut polyisobutene polymers in an extruder with hydrogen peroxide, isopropyl myristate, a copolymer of acrylates/acrylic acid, flavors, extruding a ribbon of the layer tooth-whitening flat strip and die cutting the ribbon to appropriate lengths for use in whitening a user's teeth. The method presented herein provides for a tooth-whitening flat strip that is not layered or made up of plies of material but which has the components of the flat strip effectively uniformly distributed throughout a single layer.

[0009] There is further provided herein descriptions of a composition, and methods for making such composition, wherein the composition is made by adding amounts of OPPANOL B12 and OPPANOL B50, INDOPOL H-1900, isopropyl myristate, EUDRAGIT RSPO and hydrogen peroxide to an extruder such that an extrudate has a composition which contains 60% to 80%, by weight, of a blend of OPPANOL B12, OPPANOL B50 and INDOPOL H-1900, 5% to 10% EUDRAGIT RSPO, 5% to 10% isopropyl myristate, and 15% to 30% hydrogen peroxide.

[0010] Other compositions within the scope of the present invention may be made. For example, a composition may be made by adding amounts of OPPANOL B12, OPPANOL B15 and OPPANOL B50, INDOPOL H-1900, isopropyl myristate, EUDRAGIT RSPO and hydrogen peroxide to an extruder such that an extrudate has a composition which contains 50% to 90%, by weight, of a blend of OPPANOL B12, OPPANOL B15, OPPANOL B50 and INDOPOL H-1900, 5% to 10% EUDRAGIT RSPO, 5% to 15% isopropyl myristate, and 5% to 30% hydrogen peroxide. Furthermore, PVP or PVP-CLM may be substituted for the EUDRAGIT RSPO.

**BRIEF DESCRIPTION OF THE FIGURES**

[0011] FIG. 1 is a flow chart showing the process by which a tooth-whitening flat strip of the present invention may be made by an extrusion process.

[0012] FIG. 2 is an illustration of the tooth-whitening flat strip of the present invention disposed on a release layer.
DETAILED DESCRIPTION

[0013] It has been discovered that blends of polyisobutene polymers, hydrogen peroxide, a copolymer of acrylates/acrylic acid, and flavors can be extruded into an effectively homogeneous ribbon, which surprisingly exhibits the necessary tooth-whitening and adhesive characteristics such that the extruded ribbon is useful as a tooth-whitening flat strip. More specifically, it has been discovered that blends of OPPANOL®, INDOPOL®, hydrogen peroxide, EUDRAGIT®, isopropyl myristate and flavoring and/or sweeteners can be extruded into an effectively stable solid solution, over a specified temperature range, which exhibits the requisite characteristics of adhesive and tooth-whitening to be useful as a tooth-whitening flat strip. OPPANOL, a polyisobutene, is available from BASF Automotive and Refinery Chemicals, 100 Campus Drive, Florham Park, NJ, in a range of molecular weights. INDOPOL, a polybutene, is available from Lipo Chemicals, 207 19th Avenue, Paterson, NJ, in a range of viscosities. EUDRAGIT, an acrylate copolymer, is available in a range of molecular weights from Evonik Industries AG, Rellinghauser Strafie 1-1 1, 45128 Essen, Germany.

[0014] OPPANOL in the molecular weight range of 51,000 to 340,000 (weight average molecular weight) is particularly useful in compositions of the tooth-whitening flat strip disclosed herein. More particularly, OPPANOL B12, a polyisobutene having a weight average molecular weight of 51,000; OPPANOL B15, a polyisobutene having a weight average molecular weight of 200,000; and OPPANOL B50, a polyisobutene having a weight average molecular weight of 340,000, are particularly useful in compositions of the claimed tooth-whitening flat strip. As used herein, the term OPPANOLS may refer to a single OPPANOL product or to blends of more than one OPPANOL product.

[0015] INDOPOL in a viscosity range of about 3000 centistokes to about 4200 centistokes is particularly useful in compositions of the tooth-whitening flat strip disclosed herein. It has been found that INDOPOL H-1500 and INDOPOL H-1900, which have viscosities of 3026-3381 centistokes and 3900-4200 centistokes, respectively at 100 °C, are particularly useful in compositions of the tooth-whitening flat strip disclosed herein.

[0016] EUDRAGIT in the molecular weight range of 32,000 to 320,000 g/mole is particularly useful in compositions of the tooth-whitening flat strip disclosed herein. More particularly, EURDAGIT RSPO and EUDRAGIT RLPO, which both have a molecular
weight of 32,000 g/mole, have been found useful in compositions of the claimed tooth-whitening flat strip. Furthermore, EUDRAGIT L 100-55, which has a molecular weight of 320,000 g/mole has been found useful in composition of the claimed tooth-whitening flat strip.

[0017] Compositions of the tooth-whitening flat strip provided herein may further contain flavorants and sweeteners. Suitable flavoring components may include oil of wintergreen, oil of peppermint, oil of spearmint, menthol, cinnamon, vanillin, lemon, orange, and the like. Coolants may also be part of the flavorant. In the composition of the tooth-whitening flat strip disclosed herein, suitable coolants may include oil of peppermint. The flavorant may be used in the present invention at levels of up to about 4% and preferably in one embodiment from about 0.5% to about 1.0%, by weight, of the formulation. Sweeteners may also be added to the compositions. Sweeteners may include neotame, saccharin, dextrose, sucrose, lactose, maltose, levulose, aspartame, sodium cyclamate, D-tryptophan, dihydrochalcones, acesulfame, and mixtures thereof. A sweetener may be added to an embodiment of the composition at levels of from about 0.005% to about 5%, by weight of the composition. In other embodiments, the sweetener is added at a level of from about 0.05% to about 0.1% by weight of the composition.

[0018] The tooth-whitening flat strip disclosed herein preferably effectively exhibits a stable solid solution over a temperature range of from about 0 °C to about 100 °C, but at least over a temperature range that is around room temperature. The dispersion of components of the tooth-whitening flat strip is effectively retained over the stated temperature range and the components do not separate out from the flat strip except to the extent that the components of the flat strip react with some external medium. For example, that the hydrogen peroxide reacts with a tooth surface is not an indication that the dispersion is not a stable solid solution.

[0019] The selection of the molecular weight and viscosity of the components of the tooth-whitening flat strip may be made so that the solid solution properties of the tooth-whitening flat strip are maintained at least around room temperature. Therefore, OPPANOL products other than OPPANOL B12, OPPANOL B15 AND OPPANOL B50 may be useful in making the compositions of the present invention. Furthermore, INDOPOL products other than INDOPOL H-1500 and INDOPOL H-1900 may be useful in making the compositions of the present invention. Additionally, EUDRAGIT products other than EURDAGIT RSPO,
EUDRAGIT RLPO, and EUDRAGIT L 100-55 may be useful in making the compositions of the present invention.

[0020] The following ranges of components listed in Table 1 are expected to be effective, based on extrapolations from laboratory testing, in making the tooth-whitening flat strip disclosed herein. The compositional ranges are presented as percentages on a weight-per-weight basis (%-w/w).

**TABLE 1. COMPOSITIONAL RANGES**

<table>
<thead>
<tr>
<th>Component</th>
<th>Range (%-w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPPANOL</td>
<td>1 to 99</td>
</tr>
<tr>
<td>INDOPOL</td>
<td>1 to 50</td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
<td>0.01 to 20</td>
</tr>
<tr>
<td>EUDRAGIT</td>
<td>1 to 50</td>
</tr>
<tr>
<td>Isopropyl myristate</td>
<td>0 to 10</td>
</tr>
<tr>
<td>Flavorant</td>
<td>0 to 20</td>
</tr>
<tr>
<td>Sweetener</td>
<td>0 to 20</td>
</tr>
</tbody>
</table>

[0021] Amounts of the components listed in Table 1 are selected so that the sum of the individual component weight percentages adds up to 100 percent. Isopropyl myristate, flavorant and sweetener are optional components. In a preferred embodiment, the tooth-whitening flat strip of the present invention comprises OPPANOLS, EUDRAGIT and hydrogen peroxide, with INDOPOL, isopropyl myristate, flavorant and sweetener as optional components.

[0022] FIG. 1 illustrates a process for making tooth-whitening flat strips of the present invention. As illustrated, OPPANOLS are cut to size in step 10 and then blended together in step 20. The blended cut OPPANOLS from step 20 are then fed into an extruder 30. Other components, such as INDOPOL, hydrogen peroxide, EUDRAGIT, and, optionally, isopropyl myristate, flavorant(s) and/or sweetener(s), in weight ranges that are in ratio to the amount of OPPANOL used as provided in Table 1, are also fed into the extruder of step 30 at step 35. As is known in the art, the extruder will perform a certain amount of blending and, thus, allowing the components introduced at step 35 to be blended with the OPPANOLS. An extruded ribbon of blended components exits the extruder of step 30 and is die cut into user-
friendly pieces at step 40. The die cut pieces of step 40 may then be packaged for delivery to consumers as illustrated by step 50 of process 1. Referring now to FIG. 2, a single extruded layer 110, which is the tooth-whitening flat strip of the present invention, may be placed on a release liner 120. The release liner 120 and the single extruded layer 110 comprise a unit which includes the tooth-whitening flat strip of the present invention and which may be die cut and packaged for delivery to consumers.

[0023] The release liner 120 may be formed from any material which exhibits less affinity for the single extruded layer 110 than the single extruded layer 110 exhibits for itself. The release liner 120 may comprise a rigid sheet of material such as polyethylene, paper, polyester, or other material which is then coated with a non-stick material. The release liner 120 may be coated with wax, silicone, TEFLON®, fluoropolymers, or other non-stick type materials. A preferred release liner is SCOTCHPAK™, available from 3M, 3M Center, St. Paul, MN. The release liner 120 may be cut to any size and shape as needed to provide a readily accessible means for separating the release liner 120 from the extruded layer 110. The release liner 120 may be formed from a brittle material which cracks when the strip is flexed or from multiple pieces of material or a scored piece of material. Alternatively, the release liner may be in two overlapping pieces such as used in adhesive strip bandage designs. Materials suitable for use as release agents may also be found in Kirk-Othmer Encyclopedia of Chemical Technology, Fourth Edition, Volume 21, pp. 207-218, incorporated herein by reference.

[0024] Tooth-whitening flat strips of the present invention may also be useful for killing germs and helping to control bad breath. For example, hydrogen peroxide is an oxidizer. Hydrogen peroxide has strong antiseptic properties and is used as an ingredient in mouthwash as an oxidizing and antimicrobial agent. Hydrogen peroxide is known to kill and reduce bacteria and viruses in the oral cavity. Therefore, hydrogen peroxide may effectively prevent infections and diseases due to microorganisms in the mouth. Other components known to enhance oral hygiene can be added to the extruded layer 110. For example, antiseptics such as thymol, methyl salicylate, benzalkonium chloride, chlorhexidine gluconate, and domiphen bromide may be incorporated into compositions of the present invention. Antifungal agents such as methylparaben and hexetidine may be added to compositions of the present invention. Additionally, menthol and eucalyptol may be added to control bad breath.
The tooth-whitening flat strips made using the compositional ranges of Table 1 and according to processes such as that illustrated by process 1 are stable solid solutions of the components used to make the tooth-whitening flat strips over temperature ranges that are typical of a consumer's storage and use of similar products. Thus, the tooth-whitening flat strip disclosed herein preferably effectively exhibits a stable solid solution around room temperature and preferably over a temperature range of from about 0 °C to about 100 °C. While the tooth-whitening flat strip of the present invention remains a stable solution the dispersion of components of the tooth-whitening flat strip is effectively retained and the components do not separate out from the flat strip except to the extent that the components of the flat strip react with some external medium. The shelf-life of the tooth-whitening flat strip disclosed herein is preferably more than 12 months and most preferably more than 18 months. It is expected that the hydrogen peroxide will remain generally stable in the tooth-whitening flat strip for the duration of its shelf life, which is to say that while there will be some degradation of the hydrogen peroxide over time, a sufficient amount will remain to whiten teeth effectively.

Example

It is proposed that a tooth-whitening flat strip of the present invention may be made by first cutting OPPANOL B12 and OPPANOL B50 to lengths suitable for feeding into an extruder. The cut OPPANOL B12 and OPPANOL B50 is then blended together with INDOPOL H-1900 under the application of heat. The cut and blended OPPANOL B15 is then fed into an extruder along with EUDRAGIT RSPO, isopropyl myristate, and hydrogen peroxide. The extruder blends and extrudes the component OPPANOL B12, OPPANOL B50, INDOPOL H-1900, isopropyl myristate, EUDRAGIT RSPO and hydrogen peroxide into a thin flat strip. The thin flat strip may be optionally extruded onto a release liner and cut into useable lengths. The cut dimensions of a tooth-whitening flat strip of the present invention may preferably be in the range of about 0.005 to about 0.25 inches thick, by about 0.25 to about 1.25 inches wide, and about 1 to about 4 inches long. Persons of ordinary skill in the art will understand that other sizes of the tooth-whitening flat strip may be used. The amounts of OPPANOL B12 and OPPANOL B50, INDOPOL H-1900, isopropyl myristate, EUDRAGIT RSPO and hydrogen peroxide added to the extruder result in a composition which contains about 60% to about 80%, by weight, of a blend of OPPANOL B12, OPPANOL B50 and INDOPOL H-1900, about 5% to about 10% EUDRAGIT RSPO, about
5% to about 10% isopropyl myristate, and about 15% to about 30% hydrogen peroxide. As described above, other ratios of components may be used so long as the tooth-whitening flat strip remains a stable solid solution around room temperature. An extruder suitable for making tooth-whitening flat strips of the present invention is a twin screw extruder of the types manufactured by American LEISTRITZ Extruder Corp. US, Sommerville, New Jersey.

[0027] The extrudate, which forms extruded layer 110 as shown in FIG. 2, may be characterized by a variety of known rheological methods which seek to identify rheological properties such as dynamic modulus, dynamic viscosity, dynamic compliance, die swell and other properties known to those having ordinary skill in the art.

[0028] The tooth-whitening flat strip of the present invention is conveniently applied to the teeth of a consumer such that the consumer removes a tooth-whitening flat strip from its packaging, peels the tooth-whitening flat strip away from the release liner if one is provided, then simply applies the tooth-whitening flat strip to the teeth by gently but firmly pressing the tooth-whitening flat strip on to the surface of the teeth. Depending on the size of the tooth-whitening flat strip, the strip may be folded over the crown of a consumer's tooth and may also be sized to cover both at least a portion of the front of the tooth and at least a portion of the back side of the tooth, to help ensure proper adhesion.

[0029] The tooth-whitening flat strip of the present invention effectively whitens teeth when the flat strip is contacting the teeth such that the hydrogen peroxide contained in the tooth-whitening flat strip can oxidize organic matter on the teeth, or in interstices on the surface of the teeth. The organic matter is generally responsible for causing the teeth to appear to be non-white. By oxidizing the organic matter, hydrogen peroxide effectively breaks down the organic matter into compounds which impart less color to the teeth than the organic matter. The tooth-whitening flat strip must remain in contact with the teeth for a time sufficient to allow the hydrogen peroxide and organic matter to react. The contact time during which the tooth-whitening flat strip is in contact with the teeth may range from several minutes to several hours or more.

[0030] There has been provided in accordance with the present invention and the embodiments thereof, a tooth-whitening flat strip comprising OPPANOLS, EUDRAGIT and hydrogen peroxide, with INDOPOL, isopropyl myristate, flavorant and sweetener as optional components. There has also been provided in accordance with the present invention and
embodiments thereof, a method for making a tooth-whitening flat strip comprising OPPANOLS, EUDRAGIT and hydrogen peroxide, with INDOPOL, isopropyl myristate, flavorant and sweetener as optional components. There has also been provided in accordance with the present invention and embodiments thereof, a method of applying a tooth-whitening flat strip comprising OPPANOLS, EUDRAGIT and hydrogen peroxide, with INDOPOL, isopropyl myristate, flavorant and sweetener as optional components.

[0031] While the invention has been described with specific embodiments, many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to include all such alternatives, modifications and variations within the spirit and scope of the appended claims.
CLAIMS

What is claimed is:

1. A tooth-whitening flat strip comprising:
   a polyisobutene;
   an acrylate copolymer;
   hydrogen peroxide;

   wherein, the tooth-whitening flat strip is a solid solution.

2. The tooth-whitening flat strip of Claim 1 further comprising a second polybutene.

3. The tooth-whitening flat strip of Claim 2 further comprising isopropyl myristate.

4. The tooth-whitening flat strip of Claim 3 further comprising a flavorant.

5. The tooth-whitening flat strip of Claim 4 further comprising a sweetener.

6. The tooth-whitening flat strip of Claim 1 characterized as a single layer.

7. A method for making a tooth-whitening flat strip that is a solid solution, the method comprising:

   cutting a polyisobutene to size;
   blending the cut polyisobutene;
   feeding the cut and blended polyisobutene into an extruder;
   adding an extender to the extruder;
   adding hydrogen peroxide to the extruder;
   adding an acrylate copolymer to the extruder;
   blending the cut and blended polyisobutene, the extender, the hydrogen peroxide and the acrylate copolymer in the extruder to make a solid solution;
   extruding the solid solution from the extruder;
   die cutting the extruded solid solution into flat strips suitable for consumer use; and
   packaging the die cut extruded solid solution.

8. The method of Claim 7 wherein a flavorant is added to the extruder.
9. The method of Claim 7 further wherein the extruded solid solution is placed on a release liner prior to the extruded solid solution being die cut.

10. A method of using a tooth-whitening flat strip that is a solid solution containing a polyisobutene, an acrylate copolymer, and hydrogen peroxide, the method comprising:

   applying the flat strip to a person's teeth by pressing the flat strip against the teeth;

   allowing the flat strip to remain on the teeth for a period of time sufficient for the hydrogen peroxide to oxidize organic compounds on the teeth; and

   removing the flat strip from the teeth.

11. The method of Claim 10 wherein the period of time is at least several minutes.

12. A tooth-whitening flat strip comprising:

   a blend of polyisobutenes;

   a polybutene;

   wherein the blend of polyisobutenes and the polybutene comprises from 60 percent to 80 percent, by weight of the tooth-whitening flat strip;

   5 percent to 10 percent by weight of isopropyl myristate; and

   5 percent to 10 percent by weight of an acrylate copolymer; and

   15 percent to 30 percent by weight of hydrogen peroxide;

   wherein, the tooth-whitening flat strip is a solid solution.

13. The tooth-whitening flat strip of Claim 13 further comprising a flavorant.

14. The tooth-whitening flat strip of Claim 14 further comprising a sweetener.

15. The tooth-whitening flat strip of Claim 1 further comprising PVP-CLM.

16. The tooth-whitening flat strip of Claim 16 wherein the PVP-CLM replaces the acrylate copolymer.
FIG. 1

1

10 → Cut OPPANOLS to size

20 → Blend

30 → Extrude

40 → Die cut

50 → Package

35 → Add remaining ingredients
INTERNATIONAL SEARCH REPORT

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/023041

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61C 17/00 (2014.01)

USPC - 433/216

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - A61C 17/00 (2014.01)

USPC - 433/216; 424/53, 401

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

CPC - A61C 17/00; A61Q 11/00, A61Q 11/02 (2013.01)

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

PatFt, AppFt, Orbit, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
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<tbody>
<tr>
<td>Y</td>
<td>US 201 1/0268672 A1 (MOSZYK et al) 03 November 201 1 (03.11.2011) entire document</td>
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<td>A</td>
<td>US 201 1/0104219 A1 (RAJAIHAH et al) 05 May 201 1 (05.05.2011) entire document</td>
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<td>A</td>
<td>US 6,905,673 B2 (RAJAIHAH et al) 14 June 2005 (14.06.2005) entire document</td>
</tr>
</tbody>
</table>

[ ] Further documents are listed in the continuation of Box C.

[T] later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

[X] document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

[Y] document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

[&] document member of the same patent family

Date of the actual completion of the international search
09 June 2014

Date of mailing of the international search report
03 JUL 2014

Name and mailing address of the ISA/US

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PCT Helpdesk: 571-372-4300
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