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(54) Title: LIQUID ANTIMICROBIAL COMPRISING A WATER-SOLUBLE POLYMER AND A WATER-SOLUBLE ANTIMICROBIAL AGENT

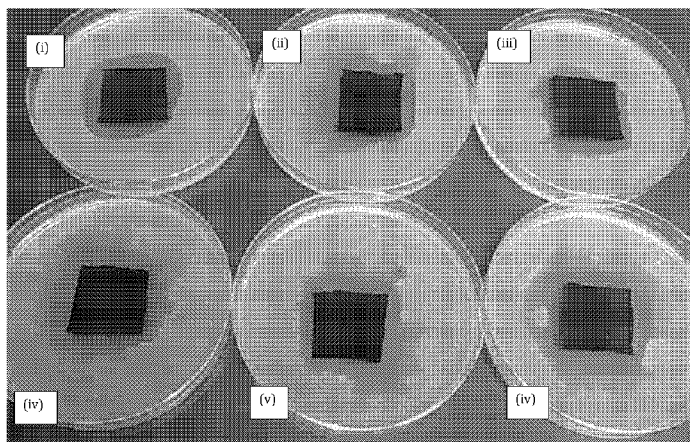


Figure 1

(57) Abstract: This invention relates to a liquid antimicrobial composition comprising: (a) water, (b) a water-soluble polymer, and (c) at least one water-soluble antimicrobial; as well as to an item of clothing, a curtain, a blind, an item of bedding, wallpaper or laundry product comprising the water-soluble polymer and the at least one water-soluble antimicrobial. This invention also relates to a method of preparing the liquid antimicrobial composition comprising the step of mixing water, a water-soluble polymer, and at least one aqueous solution of a water-soluble antimicrobial.



## LIQUID ANTIMICROBIAL COMPRISING A WATER-SOLUBLE POLYMER AND A WATER-SOLUBLE ANTIMICROBIAL AGENT

[001] This invention relates to a liquid antimicrobial composition comprising water, a water-soluble polymer and at least one water-soluble antimicrobial. The invention also relates to products incorporating or treated with the liquid antimicrobial composition.

### [002] Background

[003] It is known to incorporate antimicrobials into consumer products in order to inhibit the growth of, for example, bacteria and/or fungi and/or viruses. For absorbent fabrics such as clothing, curtains/blinds and bedding, antimicrobials can be incorporated by applying a liquid containing the antimicrobial to the fabric, and then allowing the fabric to dry.

[004] A disadvantage of applying antimicrobials in this way is that once the fabric has dried it can have a different feel on the user's skin compared to how the fabric felt to the user before treatment. This is generally considered by users of such fabrics to be unpleasant and undesirable. Thus, this invention seeks to provide a liquid antimicrobial which, when applied to an absorbent fabric which is then dried, more closely retains the original feel of the fabric.

[005] An additional problem with applying antimicrobials to absorbent fabrics as described above is that the antimicrobial will be washed out of the fabric as it is repeatedly laundered. This invention therefore also seeks to provide a liquid antimicrobial that has an increased retention time in absorbent fabrics after repeated laundry cycles.

### [006] Statement of invention

[007] This invention relates to a liquid antimicrobial composition comprising:

- (a) water,
- (b) a water-soluble polymer, and
- (c) at least one water-soluble antimicrobial.

In this way, a liquid antimicrobial is provided which can be applied to absorbent materials. It is believed that, compared to prior art compositions, the inclusion of the water-soluble polymer can provide (i) a reduced detrimental effect to the feel of the fabric, and (ii) an increased retention time in the fabric after repeated laundry cycles.

[008] In relation to this invention, the term “antimicrobial” is used to refer to a substance that can kill microorganisms or inhibit their growth. Examples of antimicrobials include germicides, antibiotics, antibacterials, antivirals and antifungals. It is preferred that the antimicrobial provides up to a log 4 reduction in the number of cells of the microorganism in question. For example, a reduction in the number of cells from  $10^8$  to  $10^4$  would be a log 4 reduction (ie killing of 99.9% of the cells in question).

[009] It is preferred that the liquid antimicrobial composition comprises:

- (a) at least 30wt% water,
- (b) 1-10wt% of the water soluble polymer, and
- (c) 5-69wt% of the at least one water-soluble antimicrobial.

[0010] Preferably, the liquid antimicrobial composition comprises:

- (a) 50-60wt% water,
- (b) 3-7wt% of the water-soluble polymer, and
- (c) 35-45wt% of the at least one water-soluble antimicrobial.

[0011] More preferably, the liquid antimicrobial composition comprises:

- (a) about 56.5wt% water,
- (b) about 5wt% of the water-soluble polymer, and
- (c) about 38.5wt% of the at least one water-soluble antimicrobial.

[0012] Preferably, the water-soluble polymer is a film forming agent, ie an agent that assists in allowing the composition to form a film (or coating) when it is applied to a substrate.

5 [0013] It is preferred that the water-soluble polymer is a water-soluble polyalkyl alcohol or a polyhexanide, preferably polyhexamethylene biguanide. The water-soluble polyalkyl alcohol is preferably polyvinyl alcohol. Preferably, the polyvinyl alcohol is at least partially hydrolysed, more preferably at least 60mole% hydrolysed. In a preferred embodiment, the polyvinyl alcohol is 85-93mole% hydrolysed. Preferably, the polyvinyl alcohol has a viscosity of 10-34 mPa·s as a 10 4wt% solution in water at 20°C. Water-soluble polymers, such as polyvinyl alcohol, are particularly preferred because they assist in retaining the water soluble antimicrobial in the fibres of the fabric to which the liquid antimicrobial composition is applied. Without wishing to be bound to any theory, it is believed that this is due to the water-soluble polymer swelling upon contact with water 15 during laundering, helping to lock the antimicrobial into the fibres of the fabric.

[0014] It is preferred that the at least one water-soluble antimicrobial is a quaternary ammonium compound. The quaternary ammonium compound is 20 preferably a quaternary ammonium alkyl compound, more preferably benzalkonium chloride or didecyldimethylammonium chloride. It is preferred that when the liquid antimicrobial composition comprises benzalkonium chloride, it is present in an amount of 5-50wt%. In some embodiments, the amount of benzalkonium chloride is 10-25wt%, preferably 15-20wt%, more preferably about 25 17.5wt%. It is preferred that when the liquid antimicrobial composition comprises didecyldimethylammonium chloride, it is present in an amount of 10-50wt%. In some embodiments, the amount of didecyldimethylammonium chloride is 14-28wt%, preferably 19-23wt%, more preferably about 21wt%.

30 [0015] In a preferred embodiment, the at least one water-soluble antimicrobial comprises two water-soluble antimicrobials. The inclusion of two antimicrobials can provide a broader spectrum of antimicrobial activity. The two water-soluble

antimicrobials are preferably benzalkonium chloride and didecyldimethylammonium chloride. It is preferred that the liquid antimicrobial composition comprises 15-20wt% benzalkonium chloride and 19-23wt% didecyldimethylammonium chloride, more preferably about 17.5wt% benzalkonium chloride and about 21wt% didecyldimethylammonium chloride.

[0016] Alternative antimicrobials that may be used in the compositions of the invention include 2-bromo-2-nitropropane-1,3-diol; polyhexanides, preferably polyhexamethylene biguanide; and/or chlorophenols, preferably 4-chloro-3,5-dimethylphenol, 2-chloro-3-methylphenol, 2,4-dichloro-3,5-dimethylphenol, 2,4-dichloro-5-methylphenol, 4-chloro-3-methylphenol and/or 2,4,6-trichlorophenol.

[0017] In some embodiments, the remainder of the liquid antimicrobial composition comprises incidental impurities.

[0018] A preferred liquid antimicrobial composition as described above comprises water, 85-93% hydrolysed polyvinyl alcohol, benzalkonium chloride, and didecyldimethylammonium chloride. A particularly preferred composition comprises:

- (a) 50-60wt% water, preferably about 56.5wt% water,
- (b) 3-7wt% of 85-93% hydrolysed polyvinyl alcohol, preferably about 5wt% of 85-93% hydrolysed polyvinyl alcohol,
- (c) 15-20wt% benzalkonium chloride, preferably about 17.5wt% benzalkonium chloride, and
- (d) 19-23wt% didecyldimethylammonium chloride, preferably about 21wt% didecyldimethylammonium chloride.

[0019] This invention also relates to a method of preparing a liquid antimicrobial composition as described above, comprising the step of mixing water, a water-soluble polymer, and at least one aqueous solution of a water-soluble antimicrobial. Preferably, the method comprises the step of mixing 25-35wt% water, 3-7wt% of the water-soluble polymer, and 60-70wt% of the at least one aqueous solution of a

water-soluble antimicrobial. More preferably, the method comprises the step of mixing about 30wt% water, about 5wt% of the water-soluble polymer, and about 65wt% of the at least one aqueous solution of a water-soluble antimicrobial. In a preferred embodiment, the method comprises the step of mixing about 30wt% water, about 5wt% of the water-soluble polymer, about 35wt% of a 50wt% aqueous solution of benzalkonium chloride, and about 30wt% of a 70wt% aqueous solution of didecyldimethylammonium chloride.

[0020] This invention also relates to a method of applying a liquid antimicrobial composition as described above to an absorbent material, comprising the step of contacting the absorbent fabric with the liquid antimicrobial composition. During the contacting step the liquid antimicrobial composition may be in the form of a liquid and/or a vapour. The absorbent material may be an absorbent fabric. Preferably, the method comprises the step of drying the material after the contacting step. In some embodiments, the amount of liquid antimicrobial composition applied to the absorbent material is 20-100g/m<sup>2</sup>, preferably 25-30g/m<sup>2</sup>, more preferably about 27g/m<sup>2</sup>.

[0021] In relation to this invention, the term "absorbent material" is used to mean any material which is capable of absorbing the liquid antimicrobial composition. In relation to this invention, the term "absorbent fabric" (for example a woven fabric such as cotton or a blend of polyester and cotton, or nonwoven fabric such as polypropylene or viscose) is used to mean a fabric or cloth which is capable of absorbing the liquid antimicrobial composition. The absorbent material may be an item of clothing, a curtain, a blind, an item of bedding, wallpaper or laundry product. Examples of items of clothing include t-shirts and socks. Examples of items of bedding include pillows and duvets.

[0022] This invention also relates to an item of clothing, a curtain, a blind, an item of bedding, wallpaper or laundry product comprising a water-soluble polymer and at least one water-soluble antimicrobial as described above. Examples of items of clothing include t-shirts and socks. Examples of items of bedding include pillows

and duvets. The composition of the invention can be particularly useful in inhibiting the growth of fungi on the dead skin that accumulates in bedding. Bedbugs are known to feed on these fungi, so inhibiting its growth reduces the viability of the bedbugs. Examples of laundry products include a liquid formulation for use during or after a laundry cycle.

[0023] This invention will be further described by reference to the following Figure which is not intended to limit the scope of the invention claimed, in which:

**Figure 1** shows a photograph of testing of the antibacterial activity of the composition of the invention after various number of washing cycles.

[0024] **Example**

[0025] A liquid antimicrobial composition was prepared by mixing (a) about 30wt% water, (b) about 5wt% of 85-93% hydrolysed polyvinyl alcohol, (c) about 35wt% of a 50wt% aqueous solution of benzalkonium chloride, and (d) about 30wt% of a 70wt% aqueous solution of didecyldimethylammonium chloride. This composition was then applied to a polycotton blend t-shirt by spraying, in an amount of around 28g/m<sup>2</sup>.

[0026] A portion of the treated t-shirt was removed i.e. after 0 washes. The treated t-shirt was then washed 10 times in a 1% solution of a biological laundry detergent at 40°C after which a sample was removed i.e. 10 washes. This procedure was repeated to give samples after 20, 30, 40 and 50 washes.

[0027] The unwashed and washed t-shirt samples were then sterilised at 121°C for 5 minutes and then tested for antibacterial activity as detailed below.

[0028] Evaluation of antimicrobial protection

[0029] Test species: *Staphylococcus aureus* (ATCC 6538)

[0030] Testing was carried out according to EN ISO 20645:2004 - Determination of antibacterial activity – agar diffusion plate test.

[0031] A lower layer, 10 ml of culture media (trypticase soy agar, TSA), was poured into sterile Petri dishes and allowed to set. Culture media (TSA), pre-cooled to approximately 45°C, was inoculated with the test bacteria and poured over the lower layer to form an upper layer and allowed to set.

[0032] Swatches 25 x 25 mm of the t-shirt samples were aseptically transferred onto the two-layer agar plates and incubated at 35°C for 24 hours.

[0033] The level of antibacterial activity was assessed by examining the extent of the bacterial growth in the contact zone between the agar and the test swatch. Inhibition zones were calculated using the following formula:

$$H = (D - d)/2$$

Where H is the inhibition zone in mm

D is the total diameter of the swatch and the inhibition zone

d is the diameter of the swatch in mm

[0034] The results of this testing are shown in Table 1 below.

| <b>SAMPLE</b> | <b>Width of clear zone of no growth</b> | <b>Bacterial growth under swatch</b> | <b>Description</b>  | <b>Conclusion</b> |
|---------------|---|--------------------------------------|---------------------|-------------------|
| 0 wash        | 42 mm                                   | No growth                            | ≥ 1 mm<br>no growth | Effective         |
| 10 washes     | 42 mm                                   | No growth                            | ≥ 1 mm<br>no growth | Effective         |
| 20 washes     | 39 mm                                   | No growth                            | ≥ 1 mm<br>no growth | Effective         |
| 30 washes     | 40 mm                                   | No growth                            | ≥ 1 mm<br>no growth | Effective         |



|           |       |           |                          |           |
|-----------|-------|-----------|--------------------------|-----------|
| 40 washes | 40 mm | No growth | $\geq 1$ mm<br>no growth | Effective |
| 50 washes | 40 mm | No growth | $\geq 1$ mm<br>no growth | Effective |

**Table 1**

5 [0035] According to the EN ISO 20645, standard inhibition zones  $\geq 1$  mm and no growth under the specimen are accepted as effective. 0 mm inhibition and slight growth are evaluated as limited effect.

[0036] A photograph of the Petri dishes used in this testing is shown in Figure 1. The samples are labelled as follows:

- 10 (i) 0 washes  
(ii) 10 washes  
(iii) 20 washes  
(iv) 30 washes  
(v) 40 washes, and  
15 (vi) 50 washes.

[0033] Test results indicate that even after 50 washes the treated t-shirt swatches demonstrated effective antibacterial protection.

**CLAIMS**

1. A liquid antimicrobial composition comprising:
  - (a) water,
  - 5 (b) a water-soluble polymer, and
  - (c) at least one water-soluble antimicrobial.
2. A liquid antimicrobial composition as claimed in claim 1, comprising:
  - (a) 50-60wt% water,
  - 10 (b) 3-7wt% of the water-soluble polymer, and
  - (c) 35-45wt% of the at least one water-soluble antimicrobial.
3. A liquid antimicrobial composition as claimed in any one of the preceding claims, wherein the water-soluble polymer is a water-soluble polyalkyl alcohol or  
15 polyhexamethylene biguanide
4. A liquid antimicrobial composition as claimed in claim 3, wherein the water-soluble polyalkyl alcohol is polyvinyl alcohol.
- 20 5. A liquid antimicrobial composition as claimed in claim 4, wherein the polyvinyl alcohol is at least partially hydrolysed.
6. A liquid antimicrobial composition as claimed in claim 5, wherein the polyvinyl alcohol is 85-93% hydrolysed.  
25
7. A liquid antimicrobial composition as claimed in any one of the preceding claims, wherein the at least one water-soluble antimicrobial is a quaternary ammonium compound.
- 30 8. A liquid antimicrobial composition as claimed in claim 7, wherein the quaternary ammonium compound is a quaternary ammonium alkyl compound.

9. A liquid antimicrobial composition as claimed in claim 8, wherein the quaternary ammonium alkyl compound is benzalkonium chloride or didecyldimethylammonium chloride.

5 10. A liquid antimicrobial composition as claimed in any one of the preceding claims, wherein the at least one water-soluble antimicrobial comprises two water-soluble antimicrobials.

10 11. A liquid antimicrobial composition as claimed in any one of the preceding claims, wherein the two water-soluble antimicrobials are benzalkonium chloride and didecyldimethylammonium chloride.

12. A liquid antimicrobial composition as claimed in claim 11, comprising 15-20wt% benzalkonium chloride and 19-23wt% didecyldimethylammonium chloride.

15 13. A method of preparing a liquid antimicrobial composition as claimed in any preceding claim, comprising the step of mixing water, a water-soluble polymer, and at least one aqueous solution of a water-soluble antimicrobial.

20 14. A method of applying a liquid antimicrobial composition as claimed in any one of claims 1-12 to an absorbent material, comprising the step of contacting the absorbent fabric with the liquid antimicrobial composition.

25 15. An item of clothing, a curtain, a blind, an item of bedding, wallpaper or laundry product comprising a water-soluble polymer as claimed in any one of claims 1-12 and at least one water-soluble antimicrobial as claimed in in any one of claims 1-12.

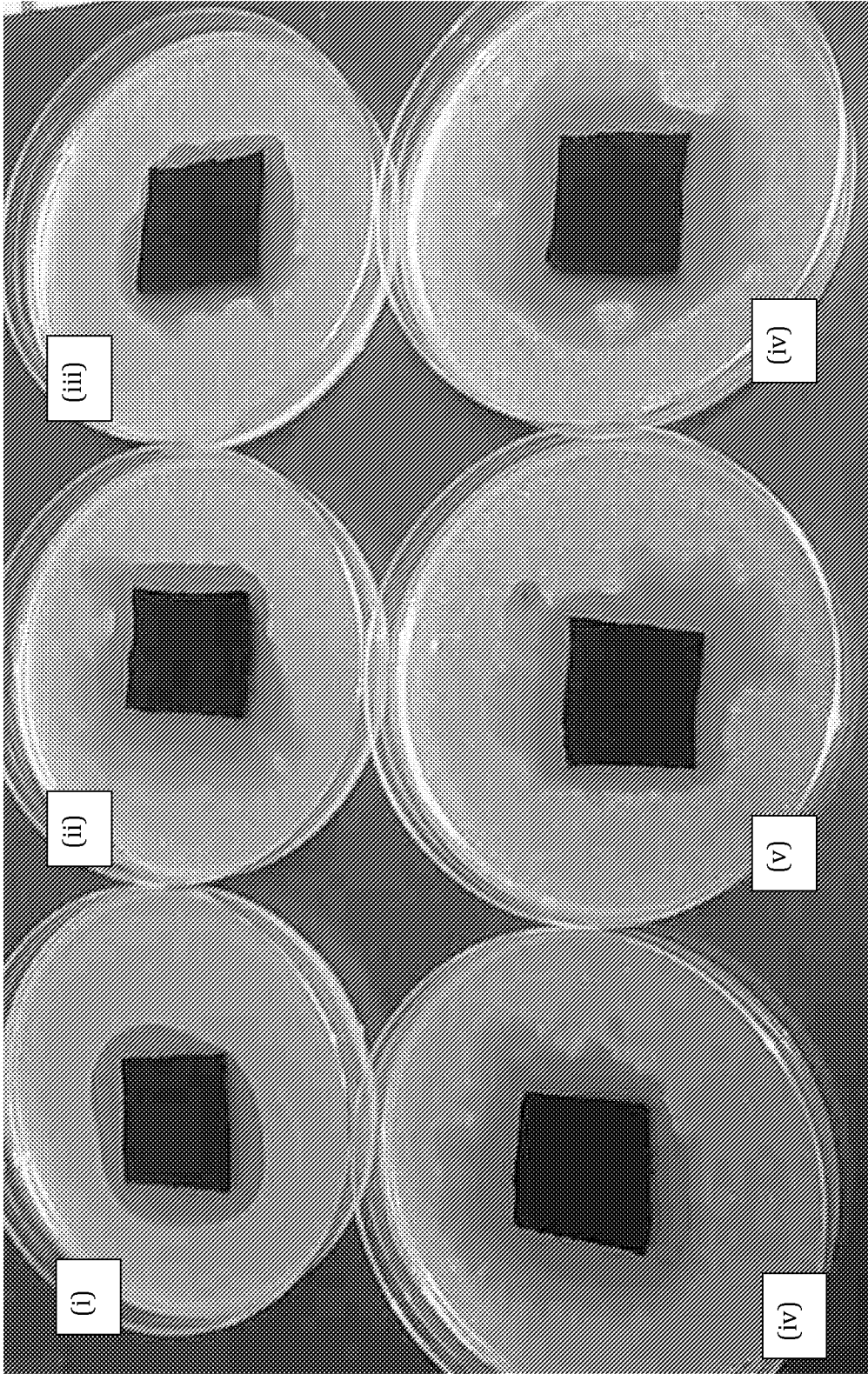


Figure 1

## INTERNATIONAL SEARCH REPORT

International application No  
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## A. CLASSIFICATION OF SUBJECT MATTER

INV. A01N33/12 A01N47/44 A01N25/24 A01N25/34 D06M13/463  
D06M15/333 A01P1/00

ADD.

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)

A01N D06M

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 practicable, search terms used)

EPO-Internal, CHEM ABS Data, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.           |
|-----------|---|---------------------------------|
| X         | "Multidose Artificial Tear Products"<br>In: "Clinical Contact Lens Practice",<br>1 January 2005 (2005-01-01), Lippincott<br>Williams & Wilkins, Philadelphia, PA,<br>U.S.A., XP055201010,<br>page 788,<br>table 41.7<br>----- | 1,3-5,<br>7-10,13               |
| X         | US 2011/251285 A1 (TIEN WALTER L [US] ET<br>AL) 13 October 2011 (2011-10-13)<br>claims 1-4<br>-----   | 1,3,4,<br>7-10,13               |
| X         | WO 2013/025783 A2 (GENTLE THOMAS M [US];<br>MATTA JOHN J [US]; HAUSER ADAM W [US];<br>GOETSCH W) 21 February 2013 (2013-02-21)<br>examples 12-04<br>claims 61, 64<br>-----  | 1,3-5,<br>7-9,<br>13-15<br>1-15 |
| Y         | -----<br>-/-  |                                 |



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search

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## INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2015/051614

| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |   |                                 |
|--|---|---------------------------------|
| Category*  | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.           |
| X  | US 2011/023240 A1 (FOSSUM RENAE DIANNA [US] ET AL) 3 February 2011 (2011-02-03)<br>composition 12<br>-----  | 1,3-5,7,<br>8,13-15             |
| X,P  | WO 2014/174272 A1 (INTELLIGENT FABRIC TECHNOLOGIES PLC [GB])<br>30 October 2014 (2014-10-30)<br>page 1, line 3 - line 4<br>example 4<br>-----   | 1,3,<br>7-10,<br>13-15          |
| X  | WO 2012/037615 A1 (GLOBAL FUTURE SOLUTIONS PTY LTD [AU]; PEMBERTON ALAN [AU])<br>29 March 2012 (2012-03-29)<br>page 14, line 15 - line 21<br>page 16, line 26 - page 20, line 30<br>----- | 1,3,<br>7-10,<br>13-15<br>1-15  |
| Y  |   |                                 |
| X  | WO 2014/060755 A1 (ARCIS BIOTECHNOLOGY HOLDINGS LTD [GB])<br>24 April 2014 (2014-04-24)<br>table IV<br>page 15, line 21 - line 25<br>-----  | 1,3,<br>7-11,<br>13-15          |
| X  | WO 2007/100654 A2 (DU PONT [US]; LU HELEN S M [US]; LENGES CHRISTIAN P [US]; STIEGLITZ BA)<br>7 September 2007 (2007-09-07)<br>example 8<br>claims 1, 5, 6<br>-----                       | 1,3-5,<br>7-9,<br>13-15<br>1-15 |
| Y  |   |                                 |
| X  | WO 2006/081617 A1 (NOVAPHARM RES AUSTRALIA [AU]; KRITZLER STEVEN [AU])<br>10 August 2006 (2006-08-10)<br>page 2, line 24 - page 3, line 2<br>example 4<br>-----                           | 1,3-5,<br>7-10,13               |
| X  | DE 29 17 276 A1 (DU PONT)<br>15 November 1979 (1979-11-15)<br>comparative example E<br>-----  | 1,3-5,7,<br>8,13                |
| X  | GB 2 475 790 A (BYOTROL PLC [GB])<br>1 June 2011 (2011-06-01)<br>-----  | 1,3,<br>7-11,<br>13-15<br>1-15  |
| Y  | reference example 1<br>example 2<br>-----   |                                 |
|  | -/--  |                                 |

## INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2015/051614

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|-----------|---|-----------------------|
| Y         | <p>"Material Safety Data Sheet - MAQUAT MQ624M",<br/> 1 August 2011 (2011-08-01), pages 1-5,<br/> XP055202006,<br/> Arlington Heights, IL, U.S.A.<br/> Retrieved from the Internet:<br/> URL: <a href="http://www.kellysolutions.com/erenewals/documentssubmit/KellyData\VA\pesticide\MSDS\10324\10324-52\10324-52_MAQUAT_MQ624M_10_12_2011_9_26_23_AM.pdf">http://www.kellysolutions.com/erenewals/documentssubmit/KellyData\VA\pesticide\MSDS\10324\10324-52\10324-52_MAQUAT_MQ624M_10_12_2011_9_26_23_AM.pdf</a><br/> [retrieved on 2015-07-13]<br/> section 2</p> | 1-15                  |
| X         | <p>-----<br/> US 5 421 898 A (CAVANAGH JAMES W [US])<br/> 6 June 1995 (1995-06-06)</p>  | 1-15                  |
| Y         | <p>claims 1, 3, 10<br/> column 3, line 13 - line 16<br/> column 5, line 37 - line 39</p>  | 1-15                  |
| A         | <p>-----<br/> US 3 429 936 A (GODT HENRY C JR)<br/> 25 February 1969 (1969-02-25)<br/> column 1, line 68 - column 2, line 3</p>   | 1                     |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2015/051614

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)  | Publication<br>date  |
|---|---------------------|---|--|
| US 2011251285 A1                          | 13-10-2011          | AU 2011237689 A1<br>CA 2796045 A1<br>CN 102883708 A<br>EP 2555748 A2<br>JP 2013523828 A<br>KR 20130041803 A<br>US 2011251285 A1<br>WO 2011127151 A2   | 08-11-2012<br>13-10-2011<br>16-01-2013<br>13-02-2013<br>17-06-2013<br>25-04-2013<br>13-10-2011<br>13-10-2011   |
| WO 2013025783 A2                          | 21-02-2013          | CA 2844791 A1<br>EP 2744328 A2<br>US 2014294749 A1<br>WO 2013025783 A2  | 21-02-2013<br>25-06-2014<br>02-10-2014<br>21-02-2013   |
| US 2011023240 A1                          | 03-02-2011          | EP 2459690 A1<br>US 2011023240 A1<br>WO 2011014643 A1   | 06-06-2012<br>03-02-2011<br>03-02-2011   |
| WO 2014174272 A1                          | 30-10-2014          | GB 2513361 A<br>WO 2014174272 A1  | 29-10-2014<br>30-10-2014   |
| WO 2012037615 A1                          | 29-03-2012          | NONE  |  |
| WO 2014060755 A1                          | 24-04-2014          | NONE  |  |
| WO 2007100654 A2                          | 07-09-2007          | AU 2007221204 A1<br>CA 2636052 A1<br>CN 101389716 A<br>CN 101454406 A<br>EP 1991624 A2<br>JP 5570123 B2<br>JP 2009527357 A<br>JP 2014167011 A<br>WO 2007100654 A2   | 07-09-2007<br>07-09-2007<br>18-03-2009<br>10-06-2009<br>19-11-2008<br>13-08-2014<br>30-07-2009<br>11-09-2014<br>07-09-2007   |
| WO 2006081617 A1                          | 10-08-2006          | BR PI0606543 A2<br>BR PI0606561 A2<br>CA 2601737 A1<br>CA 2601738 A1<br>CN 101111150 A<br>CN 101111151 A<br>EP 1845774 A1<br>EP 1845775 A1<br>IL 184911 A<br>JP 5248117 B2<br>JP 5495358 B2<br>JP 2008528135 A<br>JP 2008528737 A<br>JP 2012153735 A<br>JP 2013056938 A<br>KR 20070099629 A<br>KR 20070103011 A<br>NZ 556652 A<br>NZ 556713 A<br>TW I374008 B<br>TW I400251 B<br>US 2008138312 A1<br>US 2008167383 A1 | 30-06-2009<br>07-07-2009<br>10-08-2006<br>10-08-2006<br>23-01-2008<br>23-01-2008<br>24-10-2007<br>24-10-2007<br>30-04-2013<br>31-07-2013<br>21-05-2014<br>31-07-2008<br>31-07-2008<br>16-08-2012<br>28-03-2013<br>09-10-2007<br>22-10-2007<br>31-03-2011<br>29-01-2010<br>11-10-2012<br>01-07-2013<br>12-06-2008<br>10-07-2008 |



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2015/051614

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |            |
|---|---------------------|----------------------------|---------------------|------------|
|   |                     | US 2011135831 A1           | 09-06-2011          |            |
|   |                     | US 2012058077 A1           | 08-03-2012          |            |
|   |                     | WO 2006081617 A1           | 10-08-2006          |            |
|   |                     | WO 2006081618 A1           | 10-08-2006          |            |
|   |                     | ZA 200706205 A             | 29-10-2008          |            |
|   |                     | ZA 200706206 A             | 29-10-2008          |            |
| -----                                     |                     |                            |                     |            |
| DE 2917276                                | A1                  | 15-11-1979                 | CA 1132285 A1       | 21-09-1982 |
|   |                     |                            | DE 2917276 A1       | 15-11-1979 |
|   |                     |                            | JP S54147292 A      | 17-11-1979 |
|   |                     |                            | MX 149695 A         | 13-12-1983 |
| -----                                     |                     |                            |                     |            |
| GB 2475790                                | A                   | 01-06-2011                 | GB 2475790 A        | 01-06-2011 |
|   |                     |                            | WO 2011064554 A1    | 03-06-2011 |
| -----                                     |                     |                            |                     |            |
| US 5421898                                | A                   | 06-06-1995                 | NONE                |            |
| -----                                     |                     |                            |                     |            |
| US 3429936                                | A                   | 25-02-1969                 | DE 1645041 A1       | 14-05-1970 |
|   |                     |                            | GB 1162218 A        | 20-08-1969 |
|   |                     |                            | US 3429936 A        | 25-02-1969 |
| -----                                     |                     |                            |                     |            |