Title: **ANTIMICROBIAL FOR TEAT DIP**

**Abstract:** This invention relates to a water-soluble antimicrobial composition for use as a teat dip for cattle, the composition comprising at least two antimicrobials. The invention also relates to a liquid antimicrobial composition comprising: (a) the water-soluble antimicrobial composition, and (b) water. In addition, this invention relates to a method of preparing the water-soluble antimicrobial composition comprising the step of mixing at least two antimicrobials.
This invention relates to a water-soluble antimicrobial composition for use as a teat dip for cattle, was well as to a liquid antimicrobial comprising the water-soluble antimicrobial composition. This invention also relates to the use of the liquid antimicrobial composition.

**Background**

It is known to use substances called "teat dips" in the farming of animals such as cows, goats and sheep for their milk. These substances are generally liquids which may be applied to the animal's teats either pre- or post-milking. One main reason for using such teat dips is that they kill bacteria on the teat, as well as helping seal the teat end to prevent entry of bacteria into the udder between milkings. This can reduce the spread of bacteria (for example, into the milk that is being produced).

Many current known teat dips include formaldehyde, which is a substance known to be toxic to humans. This invention therefore seeks to provide an alternative teat dip composition which has reduced toxicity and improved functionality.

**Statement of invention**

This invention relates to a water-soluble antimicrobial composition for use as a teat dip for cattle, the composition comprising at least two antimicrobials. The water-soluble antimicrobial composition is preferably in the form of a powder.

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).

[008] It is preferred that at least one of the antimicrobials is a quaternary
ammonium compound. The quaternary ammonium compound is preferably a
quaternary ammonium alkyl compound. More preferably, the quaternary
ammonium alkyl compound is benzalkonium chloride or
didecyldimethylammonium chloride.

[009] In a preferred embodiment, the composition comprises two quaternary
ammonium compounds. Preferably, the composition comprises two quaternary
ammonium alkyl compounds. More preferably, the composition comprises
benzalkonium chloride and didecyldimethylammonium chloride.

[0010] In a preferred embodiment, the composition additionally comprises a third
antimicrobial. The third antimicrobial is preferably 2-bromo-2-nitropropane-1,3-
diol.

[0011] Alternative antimicrobials that may be used in the compositions of the
invention include polyhexanides, preferably polyhexamethylene biguanide, and/or
chlorophenols, preferably 4-chloro-3,5-dimethylphenol, 2-chloro-3-methyl-phenol,
2,4-dichloro-3,5-dimethylphenol, 2,4-dichloro-5-methylphenol, 4-chloro-3-
methylphenol and/or 2,4,6-trichlorophenol.

[0012] A particular preferred composition comprises benzalkonium chloride,
didecyldimethylammonium chloride and 2-bromo-2-nitropropane-1,3-diol.

[0013] This invention also relates to a liquid antimicrobial composition comprising:
(a) a water-soluble antimicrobial composition as described above, and
(b) water.
[0014] Preferably, the liquid antimicrobial composition additionally comprises a surfactant, more preferably a cationic surfactant. The cationic surfactant is preferably cocamidopropyl betaine. Cationic surfactants are preferred in compositions comprising cationic antimicrobials such as quaternary ammonium compounds. This is because anionic surfactants tend to deactivate cationic antimicrobials.

[0015] In some embodiments of the liquid antimicrobial composition, the weight ratio of (a), optionally including the cationic surfactant, to (b), is 1:4 to 1:8. More preferably, the weight ratio of (a), optionally including the cationic surfactant, to (b), is about 1:6. Such compositions can be supplied as a "concentrate" for the end user (ie a farmer) to dilute with water.

[0016] In some embodiments of the liquid antimicrobial composition, the weight ratio of (a), optionally including the cationic surfactant, to (b), is 1:15 to 1:25. More preferably, the weight ratio of (a), optionally including the cationic surfactant, to (b), is about 1:20. Such compositions are suitable for use as a teat dip without further dilution.

[0017] This invention also relates to a method of preparing a water-soluble antimicrobial composition as described above, comprising the step of mixing at least two antimicrobials. Preferably, the mixing step comprises mixing three antimicrobials. It is preferred that the antimicrobials are powders.

[0018] This invention also relates to a method of applying the liquid antimicrobial composition as described above to the teat of a cow, goat or sheep.
CLAIMS

1. A water-soluble antimicrobial composition for use as a teat dip for cattle, the composition comprising at least two antimicrobials.

2. A composition as claimed in claim 1, wherein at least one of the antimicrobials is a quaternary ammonium compound.

3. A composition as claimed in claim 2, wherein the quaternary ammonium compound is a quaternary ammonium alkyl compound.

4. A composition as claimed in claim 3, wherein the quaternary ammonium alkyl compound is benzalkonium chloride or didecyldimethylammonium chloride.

5. A composition as claimed in any one of the preceding claims, comprising two quaternary ammonium compounds.

6. A composition as claimed in claim 5, comprising two a quaternary ammonium alkyl compounds.

7. A composition as claimed in claim 6, comprising benzalkonium chloride and didecyldimethylammonium chloride.

8. A composition as claimed in any one of the preceding claims, additionally comprising a third antimicrobial.

9. A composition as claimed in claim 8, wherein the third antimicrobial is 2-bromo-2-nitropropane-1,3-diol.

10. A liquid antimicrobial composition comprising:
    (a) a water-soluble antimicrobial composition as claimed in any one of the preceding claims, and
(b) water.

11. A liquid antimicrobial composition as claimed in claim 10, additionally comprising a cationic surfactant.

12. A liquid antimicrobial composition as claimed in claim 11, wherein the cationic surfactant is cocamidopropyl betaine.

13. A liquid antimicrobial composition as claimed in any one of claims 10-12, wherein the weight ratio of (a), optionally including the cationic surfactant, to (b), is 1:4 to 1:8.

14. A liquid antimicrobial composition as claimed in any one of claims 10-12, wherein the weight ratio of (a), optionally including the cationic surfactant, to (b), is 1:15 to 1:25.

15. A method of preparing a water-soluble antimicrobial composition as claimed in any one of claims 1-9, comprising the step of mixing at least two antimicrobials.

16. A method as claimed in claim 15, wherein the mixing step comprises mixing three antimicrobials.
## INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

- INV. A01N33/12
- A01N35/08
- A01N25/02
- A61K31/74
- A01J7/04
- AO1Pl/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
- Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
- Electronic database consulted during the international search (name of database and, where practicable, search terms used):
  - EPO-Internal, WPI Data, CHEM ABS Data

### 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>CA 1 135 192 Al (WILSON EDWARD S) 9 November 1982 (1982-11-09) abstract page 2, lines 6-31 page 4, line 3 - page 5, line 20</td>
<td>1-8, 10, 13-16</td>
</tr>
<tr>
<td>Y</td>
<td>GB 1 554 615 A (WILSON E S) 24 October 1979 (1979-10-24) page 1, lines 23-41 page 2, line 28 - page 3, line 6</td>
<td>1-8, 10, 13-16</td>
</tr>
<tr>
<td>X</td>
<td>WO 02/069954 Al (MCJ INC [US] ; DYER DAVID L [US]) 12 September 2002 (2002-09-12) page 1, lines 20-23 page 7, line 22 - page 9, line 16 Solu tions 1, 2; page 15; example 1</td>
<td>1-8, 10-16</td>
</tr>
</tbody>
</table>

**See patent family annex.**

**Further documents are listed in the continuation of Box C.**

**Special categories of cited documents:**

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published or after the international filing date
- "L" document which may throw doubts on priority claims(s) one which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

**"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

**"A" document member of the same patent family

Date of the actual completion of the international search: 29 June 2015

Date of mailing of the international search report: 06/07/2015

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

Hatel ey, Marti n
<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>Y</td>
<td>US 4 049 830 A (PUGLISE PETER T) 20 September 1977 (1977-09-20) col umn 1, l i nes 6-9 col umn 2, l i nes 28-58 example s 1-6</td>
<td>9</td>
</tr>
<tr>
<td>X</td>
<td>EP 0 282 211 A2 (BETZ EUROPE INC [US]) 14 September 1988 (1988-09-14) abstract page 3, l i nes 9-11 , 30-34 table s I-11</td>
<td>1-3 , 10, 15</td>
</tr>
<tr>
<td>Y</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>CA 1135192 A1</td>
<td>09-11-1982</td>
<td>NONE</td>
</tr>
<tr>
<td>GB 1554615 A</td>
<td>24-10-1979</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 02069954 A1</td>
</tr>
<tr>
<td>US 4049830 A</td>
<td>20-09-1977</td>
<td>CA 1059900 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 4049830 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 1131588 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 1303488 C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 3874572 D1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 3874572 T2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 0282211 A2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NZ 223362 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 4725624 A</td>
</tr>
</tbody>
</table>