PATENT SPECIFICATION (11) 1 569 373

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(19)

(54) DISINFECTANT

(71) We, HOECHST AKTIENGESELLSCHAFT, a Body Corporate organised according to the laws of the Federal Republic of Germany, of 6230 Frankfurt/Main 80, Postfach 80 03 20, Federal Republic of Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention is an improvement in or relating to a disinfectant forming the subject of British Patent Specification No. 1459324.

The main patent specification relates to a disinfectant that is effective against pathogenic bacteria, viruses, fungi, helminthic ova and the oocysts of protozoa, especially the oocysts of different species of coccidia. Coccidia, the pathogenic bacteria of coccidiosis, are protozoa which may be found in all species of fowls, in other birds and in a great number of domestic and commercially reared animals, especially rabbits, sheep, cattle, dogs and cats. The disinfectant of Patent Specification No. 1,459,324 is therefore particularly useful for disinfecting buildings which house domestic and commercially reared animals, especially stables, outbuildings, kennels and poultry houses.

Oocysta having solid protective walls are generally hard to kill by disinfective substances because the usual disinfectants cannot penetrate into the interior of these permanent forms. This is especially true in the case of oocysts of coccidia, which are especially well protected against all the usual disinfective substances by their lipid-containing keratin walls.

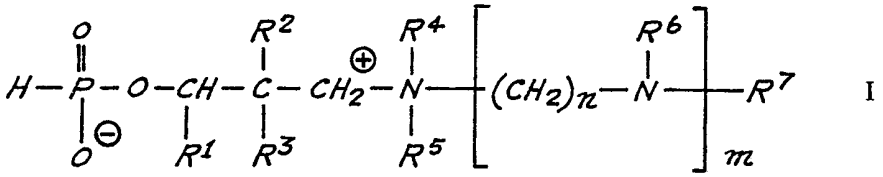
Some commercially available disinfectants comprise one or more of the following substances as active ingredients against oocysts of coccidia: phenolic soaps, sodium hypochlorite in admixture with sodium hydroxide solution, carbon disulphide, chlorinated lime, phenols, chlorophenols, cresols, chlorocresols, cresol-sulphonic acids, cresol soaps, coal tar oils, resin soaps, chlorothymol, iodine (colloidal) and others (cf. Deutsche Tierärztliche Wechenschrift 80, 23, pages 541—564 (1973)).

The solvent in such disinfectant preparations is generally a chlorinated hydrocarbon, in most cases with the addition of an emulsifier, so that a homogeneous dispersion of the disinfectant is produced when it is diluted with water to the required concentration for use.

A certain number of substances that kill oocysts are known, for example, carbon disulphide, cresol, lysol, chloroform, and methylene dichloride, but practically all of these substances need too long a period of time and too high a concentration to achieve effective destruction of the organisms.

One exception to the usual long period of action is carbon disulphide. This compound, however, at the required concentration to be applied, raises considerable draw-backs, for example, in its toxicity to humans and animals, its strong odour, its combustibility which involves the danger of fires and the formation of explosive mixtures, and in difficulty in its processing in industry.

Patent Specification No. 1 459 324 describes and claims disinfectants which comprise a compound of the formula I



I

in which R^1 represents a hydrogen atom or a methyl group, R^2, R^3, R^4, R^5 and R^6, which may be identical or different, each represents a hydrogen atom or an alkyl radical having from 1 to 4 carbon atoms,
R^7 represents an alkyl or alkenyl group having from 8 to 18 carbon atoms,
n is 2 or 3 and
m is zero or an integer from 1 to 4, in admixture with one or more chlorinated hydrocarbons.

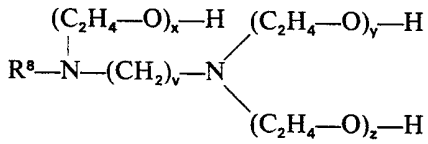
Suitable chlorinated hydrocarbons are aliphatic compounds, especially low molecular weight alkanes and alkenes bearing one or more chlorine atoms, for example, methylene chloride, chloroform, carbon tetrachloride, ethylene chloride, trichloroethane, tetrachloroethane and tetrachloroethylene, furthermore chlorinated aromatic compounds, for example, chlorobenzene, dichlorobenzene, trichlorobenzene, and tetrachlorobenzene. A mixture of any two or more chlorinated hydrocarbons may be used.

The disinfectants are advantageously diluted with water to a content of active matter of from 0.25 to 10% by weight, prior to use.

The disinfectants of the above patent specification have a strong disinfective action against pathogenic bacteria, fungi, worm ova and a number of viruses, and especially against permanent forms of oocysts.

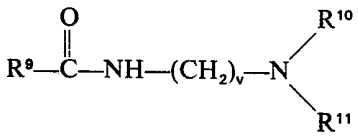
The present invention is based on the observation that the disinfective action, especially against oocysts of coccidia, of the disinfectants described and claimed in the above patent specification can be improved considerably by adding to the claimed compound certain further compounds.

The present invention accordingly provides a disinfectant preparation which comprises a mixture of
(i) a compound of the formula I as defined above,
(ii) one or more hydrocarbons selected from aromatic non-chlorinated hydrocarbons, aromatic chlorinated hydrocarbons and aliphatic chlorinated hydrocarbons, and
(iii) a compound of the formula II.



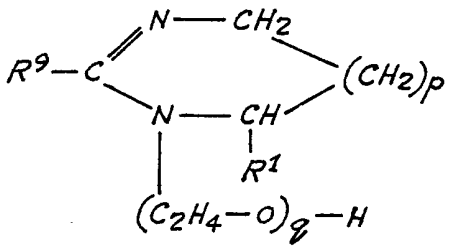
II

or a compound of the formula III



III

or a compound of the formula IV



IV

or a mixture of any two or more compounds of the formulae II to IV, in which formulae R^8 represents an alkyl or alkenyl radical having from 8 to 18 carbon atoms,
R^9 represents an alkyl or alkenyl radical having from 7 to 17 carbon atoms,
R^{10} and R^{11} which may be the same or different, each represent a hydrogen atom, or a methyl or ethyl group,
R^1 represents a hydrogen atom or a methyl group,
x, y and z each represent zero, 1 or 2,
v is 2 or 3,
p is zero or 1 and
q is zero or 1.

R^8 preferably stands for an alkyl or alkenyl radical having from 12 to 16 carbon atoms, and R^9 preferably stands for an alkyl or alkenyl radical having from 11 to 17 carbon atoms.

The compounds of the formulae II, III and IV are known, that is to say, described in the literature of the art or in actual use in the art.

Compounds of the formula II are, for example, tallow fatty propylene diamine, coconut propylene diamine, lauryl ethylene diamine, lauryl propylene diamine and the triethoxy, tetraethoxy and hexaethoxy derivatives of these compounds.

Preferred compounds of the formula III are the following amines:
N,N-dimethyl-N-(3-laurylamidopropyl)-amine,
N,N-diethyl-N-(2-oleylamidoethyl)-amine,
N,N-diethyl-N-(2-laurylamidoethyl)-amine,
N,N-dimethyl-N-(3-coconutalkylamidopropyl)-amine,*
N,N-dimethyl-N-(3-tallow fat alkylamidopropyl)-amine,
N,N-dimethyl-N-(3-oleylamidopropyl)-amine,
N,N-dimethyl-N-(2-laurylamidoethyl)-amine,
N,N-dimethyl-N-(2-oleylamidoethyl)-amine,
N,N-diethyl-N-(3-laurylamidopropyl)-amine,
N,N-diethyl-N-(3-oleylamidopropyl)-amine,
N,N-diethyl-N-(2-coconutalkylamidoethyl)-amine.

The following are preferred compounds of the formula IV: 2-undeccyl-imidazoline, 2-oleyl-imidazoline, 2-undecyl-tetrahydropyrimidine, 2-oleyltetra-hydropyrimidine, 2-heptadecyl imidazoline, 2-undecyl-4-methyl-imidazoline, 2-heptadecyl-4-methylimidazoline, 2-undecyl-3-hydroxyethyl-imidazoline, 2-oleyl-3-hydroxyethyl-imidazoline, 2-undecyl-3-hydroxyethyl-tetrahydropyrimidine and 2-oleyl-4-methyl-imidazoline.

The hydrocarbons are chlorinated aliphatic compounds, especially chlorinated low molecular weight alkanes and alkenes bearing one or more chlorine atoms, for example, methylene chloride, chloroform, carbon tetrachloride, ethylene chloride, trichlorethane and tetrachloroethylene; chlorinated aromatic compounds, for example, chlorobenzene, dichlorobenzene, trichlorobenzene, tetrachlorobenzene; and also aromatic hydrocarbons, for example, benzene and alkylbenezenes, for example xylene or toluene. Any mixture of two or more of these hydrocarbons may be used.

Prior to use, the disinfectant of the invention is advantageously diluted with water. To prepare a homogeneous dispersion, an emulsifier may be added, for example, a fatty acid polyglycol ester, alkylbenzene sulphonate, chlorinated paraffin sulphonate, sulphosuccinic acid ester, or oxethylated alkylphenol, or a mixture of two or more of these compounds.

A disinfectant preparation according to the present invention preferably comprises 100 parts by weight of a mixture of from 5 to 70 parts by weight, advantageously 10 to 30 parts by weight, of a compound of the formula I, 95 to 30 parts by weight, advantageously 90 to 70 parts by weight, of a chlorinated hydrocarbon or of a non-chlorinated aromatic hydrocarbon or of a mixture of any two or more of such hydrocarbons, and from 0.2 to 0.9 mol advantageously 0.3 to 0.8 mol, of a compound of the formulae II, III or IV or of a mixture of any two or more of these compounds, calculated on 1 mol of the compound of the formula I.

Prior to use, the disinfectant according to the invention is advantageously diluted with water, optionally with the addition of from 0.1 to 30 % by weight of an

(* coconutalkyl = an alkyl radical having a chain distribution analogous to that of coconut fatty acid.)

emulsifier, to give a solution having a content of from 0.5 to 10 % by volume of the disinfectant.

The disinfectant preparation according to the invention is particularly useful for the disinfection of surfaces and objects used in the breeding and raising of domestic and commercially reared animals, especially for the disinfection of stables and their outruns, kennels and poultry houses. These methods are also part of the invention.

The superiority of the mixtures according to the invention can be shown by the following method:

Oocysts of *Eimeria tenella* were collected from the excrement of hens previously infected and subjected to the test substances for the periods of time and at the concentrations indicated in the following Table. The preparations were then washed once with dimethyl formamide and five times with water with centrifugation and the oocyst-containing sediment was used for the oral infection of 4 day old chicks. Each of 4 to 8 animals per concentration applied were administered about 2—3 x 10^5 treated oocysts.

After termination of the test, the average body weight per test group (absolute average weight increase, respective weight decrease) was ascertained. The excrement of each chick was inspected every day during the whole test period and judged according to the following scheme:

Excrement findings:	*Judgement:*
normally formed, solid, sporadically pultaceous (brown)	1
mainly normally formed, partly liquid, mucous (green-white)	2
mainly liquid, watery, minimal blood admixtures, mucous	3
liquid, mucous, distinct blood admixtures	4

After termination of the test, the birds were killed with chloroform and the appendices were subjected to macroscopic and microscopic examination for pathological and anatomical changes.

The judgements of the pathological changes of the intestinal mucusa were determined as follows:

Intestinal mucosa:	*Judgement:*
no special findings	1
swollen, gelatinous, glassy, catarrhal fibrinous inflammations	2
sporadically petechiae, local haemorrhagic inflammations	3
diffuse pin-turning to diffuse haemorrhagic inflammation, partly sanguinous intestinal contents.	4

The number of the non-sporulated oocysts excreted in the excrements were counted.

Number of oocysts per visual field	*Judgement:*
1	1
2 — 10	2
11 — 50	3
51 — 200	4
201 — 400	5
over 400	6

The following Table shows the synergistic disinfection effect of the mixtures according to the invention, compared with mixtures of compounds of the formula I and of chlorinated organic solvents which contain no amines of the formulae II to IV.

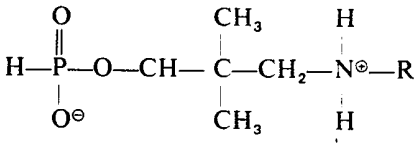
Moreover the Table shows the superiority of the mixtures according to the invention, over the commercial preparation Dekaseptol (Trade Mark).

The concentrations are indicated in % by volume and are calculated on the content of the mixture according to the invention.

In the colums heated "excrement findings", "appendix findings" and "oocysts/unit field" the above judgements were used.

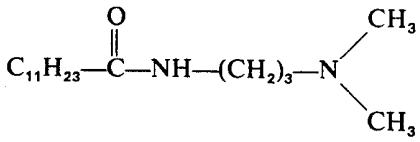
The following preparations were examined, by way of example:

1) 20.0 g of



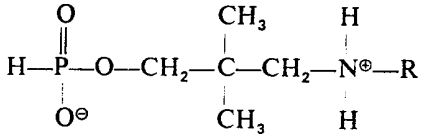
R = an alkyl radical of coconut fatty acid.

10.0 g of



(which corresponds to 0.58 mol calculated on 1 mole of phosphite)
20.09 g of castor oil · 40 moles of ethylene oxide
79.1 g of tetrachloroethylene

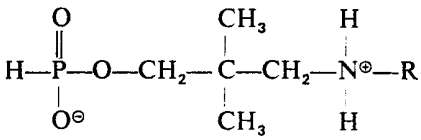
2) 20.0 g of



R = an alkyl radical of the coconut fatty acid

7.5 g of tallow fat propylene diamine · 3 mols of ethylene oxide (corresponding to 0.58 mol per 1 mol of phosphite)
0.6 g of calcium salt of dodecylbenzenesulfonate
19.4 g of castor oil · 36 mols of ethylene oxide
85.9 g of tetrachloroethylene

3) 20.0 g of

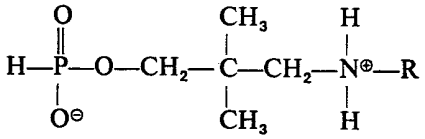


R = an alkyl radical of coconut fatty acid

7.5 g of 2-undecylimidazoline
(corresponding to 0.58 mol per 1 mol of phosphite)
2.7 g of calcium salt of dodecylbenzene-sulfonate
17.3 g of castor oil · 36 mols of ethylene oxide
82.1 g of tetrachloroethylene

4) *Comparative Example:*

20.0 g of

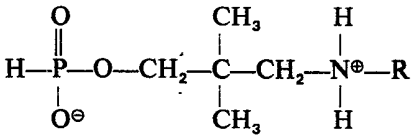


R = an alkyl radical of coconut fatty acid

2.3 g of calcium salt of dodecylbenzene-sulfonate
10.2 g of castor oil · 36 mols of ethylene oxide
108.5 g of tetrachloroethylene

5) *Comparative Example:*

20.0 g of



R = an alkyl radical of coconut fatty acid

91.0 g of *o*-dichlorobenzene
8.0 g of castor oil · 36 mols of ethylene oxide

6) *Comparative Example:*
Dekaseptol (Trade Mark, a mixture of chlorinated hydrocarbons and carbon sulfide in admixture with a special soap solution)

TABLE

Disinfection effect of different preparations against sporulated oocysts of Eimeria tenella after a 20 minutes suspension (suspension test in tap water)

Preparation	Concentration % by vol.	Excrement findings +d: 5,6,7*	Total number of surviving animals	Weight increase in g	Caecum section findings +d 7/4 animals	Oocysts/unit field +d 7/4 animals
1.	1	1 1 1	4/4	+22.3	1 1 1 1	0 0 0 0
	2	1 1 1	4/4	+25.8	1 1 1 1	0 0 0 0
2.	1	1 1 1	4/4	+23.7	1 1 1 1	0 0 0 0
	2	1 1 1	4/4	+24.6	1 1 1 1	0 0 0 0
3.	1	1 1 1	4/4	+22.8	1 1 1 1	0 0 0 0
	2	1 1 1	4/4	+22.6	1 1 1 1	0 0 0 0
4.	1	2 3 4	3/4	+11.8	2 3 3 4	5 4 4 5
	2	2 2 2	3/4	+16.9	1 2 1 2	2 3 0 3
	3	1 1 1	4/4	+16.3	1 1 1 1	0 0 0 1
5.	1	3 2 3	4/4	+12.0	2 4 3 2	4 4 3 4
	2	2 1 2	4/4	+15.8	1 2 2 1	3 2 2 2
	3	1 1 1	4/4	+19.5	1 1 1 1	1 0 0 1
6.	1	2 3 3	3/4	+10.3	3 3 3 4	5 6 4 2
	2	2 2 3	3/4	+12.7	2 3 2 4	6 3 5 6
	3	1 2 2	4/4	+16.2	1 1 2 2	3 0 2 0
	6	1 1 1	4/4	+20.3	1 1 1 1	1 1 0 2

*d = day after infection.

TABLE (Continued)

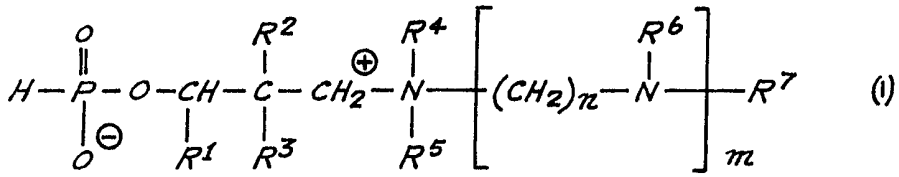
Preparation	Concentration % by vol.	Excrement findings +d: 5,6,7	Total number of surviving animals	Weight increase in g	Caecum section findings +d 7/4 animals	Oocysts/unit field +d 7/4 animals
Infection control	–	2 4 4	0/4	–	4 4 4 4	– – – –
Non infested control substance	–	1 1 1	4/4	–24.3	1 1 1 1	0 0 0 0

It can be seen from the Table that the disinfection effect of the preparations 1, 2 and 3, after dispersion in water, at an aqueous concentration of 1 % is distinctly superior to that of the preparations 4 and 5 which contain no amine. Only when used in a 3-fold higher concentration has the preparation 4 about the same disinfection effect against sporulated oocysts of *Eimeria tenella* as the preparations 1, 2 and 3. The preparations according to the invention in a 1 % concentration have a pronounced superiority over Dekasepol used in the same concentration, and a six-fold concentration of Dikasepol is required to give a disinfection that approaches that of the preparations of the invention.

WHAT WE CLAIM IS:—

1. A disinfectant preparation which comprises a mixture of

(i) a compound of the formula I



(I)

in which

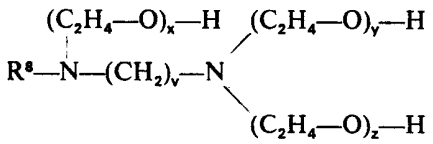
R^1 represents a hydrogen atom or a methyl group,

R^2, R^3, R^4, R^5 and R^6, which may be identical or different, each represents a hydrogen atom or an alkyl radical having from 1 to 4 carbon atoms,

R^7 represents an alkyl or alkenyl group, having from 8 to 18 carbon atoms,

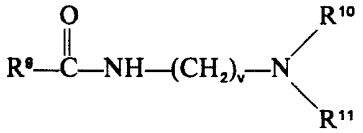
n is 2 or 3 and

m is zero or an integer from 1 to 4,
(ii) one or more hydrocarbons selected from chlorinated hydrocarbons and aromatic non-chlorinated hydrocarbons, and
(iii) a compound of the formula II



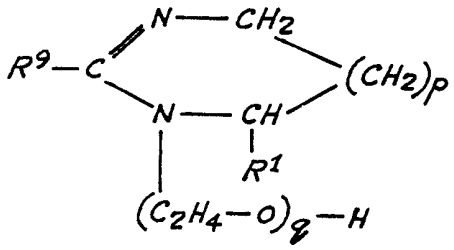
II

or a compound of the formula III



III

or a compound of the formula IV



(IV)

or a mixture of any two or more of the compounds of the formulae II to IV, in which
R^8 represents an alkyl or alkenyl radical having from 8 to 18 carbon atoms.
R^9 represents an alkyl or alkenyl radical having from 7 to 17 carbon atoms,
R^{10} and R^{11}, which may be the same or different, each represent a hydrogen atom, or a methyl or ethyl group
R^1 represents a hydrogen atom or a methyl group,
x, y and z each stand for 1 or 2,
v stands for 2 or 3,
p is zero or 1 and
q is zero or 1.

2. A disinfectant preparation as claimed in claim 1, wherein R^8 represents an alkyl or alkenyl radical having from 12 to 16 carbon atoms and R^9 represents an alkyl or alkenyl radical having from 11 to 17 carbon atoms.

3. A disinfectant preparation as claimed in claim 1 or claim 2, wherein a compound of formula II is tallow fatty propylene diamine, coconut propylene diamine, lauryl ethylene diamine, lauryl propylene diamine, or a triethoxy, tetraethoxy or hexaethoxy derivative of such a compound.

4. A disinfectant preparation as claimed in any one of claims 1 to 3, wherein a compound of formula III is
N,N-dimethyl-N-(3-laurylamidopropyl)-amine,
N,N-diethyl-N-(2-oleylamidoethyl)-amine,
N,N-diethyl-N-(2-laurylamidoethyl)-amine,
N,N-dimethyl-N-(3-coconutalkylamidopropyl)-amine,
N,N-dimethyl-N-(3-tallow fat alkylamidopropyl)-amine,
N,N-dimethyl-N-(3-oleylamidopropyl)-amine,
N,N-dimethyl-N-(2-laurylamidoethyl)-amine,
N,N-dimethyl-N-(2-oleylamidoethyl)-amine,
N,N-diethyl-N-(3-laurylamidopropyl)-amine,
N,N-diethyl-N-(3-oleylamidopropyl)-amine,
N,N-diethyl-N-(2-coconutalkylamidoethyl)-amine.

5. A disinfectant preparation as claimed in any one of claims 1 to 4, wherein a compound of formula IV is

2-undecyl-imidazoline, 2-oleyl-imidazoline, 2-undecyl-tetrahydropyrimidine, 2-oleyltetrahydropyrimidine, 2-heptadecyl imidazoline, 2-undecyl-4-methyl-imidazoline, 2-heptadecyl-4-methylimidazoline, 2-undecyl-3-hydroxyethyl-imidazoline, 2-oleyl-3-hydroxyethyl-imidazoline, 2-undecyl-3-hydroxyethyl-tetrahydropyrimidine or 2-oleyl-4-methylimidazoline.

6. A disinfectant preparation as claimed in any one of claims 1 to 5, which comprises 100 parts by weight of a mixture of from 5 to 70 parts by weight of a compound of formula I, from 95 to 30 parts by weight of the hydrocarbon component (ii), and from 0.2 to 0.9 mol, calculated on 1 mol of the compound of formula I, of a compound of formula II, III or IV or a mixture thereof.

7. A disinfectant preparation as claimed in claim 6, which comprises 100 parts by weight of a mixture of from 10 to 30 parts by weight of a compound of formula I, from 90 to 70 % by weight of the hydrcarbon component (ii) and from 0.3 to 0.8 mol. of a compound of formula II, III or IV or a mixture thereof.

8. A disinfectant preparation as claimed in any one of claims 1 to 7, in aqueous solution.

9. A disinfectant preparation as claimed in claim 8, wherein an aqueous solution comprises from 0.5 to 10 % by volume of the preparation.

10. A disinfectant preparation as claimed in any one of claims 1 to 9, which also comprises an emulsifier.

11. A disinfectant preparation as claimed in claim 10, which comprises from 0.1 to 30 % by weight of the emulsifier.

12. A disinfectant preparation as claimed in claim 1, and which is substantially as described in any one of Examples 1 to 3.

13. A method of disinfecting a surface or object infected or liable to infection with pathogenic bacteria and/or protozoa, which comprises applying to the surface or object a disinfectant preparation as claimed in any one of claims 1 to 12.

14. A method as claimed in claim 13, wherein the surface or object is in or connected with premises for the breeding and/or raising of domestic and commercially reared animals.

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