



(86) Date de dépôt PCT/PCT Filing Date: 1999/09/25  
(87) Date publication PCT/PCT Publication Date: 2000/05/18  
(45) Date de délivrance/Issue Date: 2007/05/08  
(85) Entrée phase nationale/National Entry: 2001/05/04  
(86) N° demande PCT/PCT Application No.: EP 1999/007151  
(87) N° publication PCT/PCT Publication No.: 2000/027192  
(30) Priorité/Priority: 1998/11/05 (DE198 50 994.4)

(51) Cl.Int./Int.Cl. *A01N 31/02* (2006.01),  
*A01N 25/32* (2006.01), *A01N 37/02* (2006.01),  
*A01N 37/10* (2006.01), *A01N 37/36* (2006.01),  
*A01N 37/40* (2006.01), *A01N 37/42* (2006.01)  
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(54) Titre : AGENT POUR DESACTIVER LES ORGANISMES PATHOGENES DE PLANTES  
(54) Title: AGENT FOR INACTIVATING PATHOGENIC ORGANISMS OF PLANTS

(57) **Abrégé/Abstract:**

The invention relates to disinfecting agents for combating and inactivating phytopathogenic organisms, for use on plants and in their environment. The agents are based on a mixture of anionic active surfactants, aliphatic and aromatic carboxylic acids, glycols, hydrotropic agents and aliphatic monovalent alcohols, and are characterized in that they contain, together with the hydrotropic agents and monovalent alcohols, a combination of aliphatic and aromatic carboxylic acids, alkyl- and/or alkylarylsulfonates, as well as certain individual or mixed glycols.

## ABSTRACT

The invention relates to disinfecting agents for combating and inactivating phytopathogenic organisms, for use on plants and in their environment. The agents are based on a mixture of anionic active surfactants, aliphatic and aromatic carboxylic acids, glycols, hydrotropic agents and aliphatic monovalent alcohols, and are characterized in that they contain, together with the hydrotropic agents and monovalent alcohols, a combination of aliphatic and aromatic carboxylic acids, alkyl- and/or alkylarylsulfonates, as well as certain individual or mixed glycols.

## AGENT FOR INACTIVATING PATHOGENIC ORGANISMS OF PLANTS

Every year, truck farms, meristem operations and plant cultivators sustain great damage due to organisms that infect sets (e.g. plantlets), young plants, mother plants and seeds, destroying them or rendering them useless. If, for example, viruses enter a cultivation, it can be assumed that 100 % of the plants will be damaged. The only option open to the truck farms then is the radical measure of destroying the entire culture.

Specifically active agents are commercially available with which a few phytopathogens can be combated without influencing the vitality of the plant. These agents, designated as pesticides, are systemically effective but usually have only a narrow spectrum of activity.

On the other hand, a significantly broader spectrum of activity is offered by common disinfecting agents based on aldehydes, phenols, halogens, peroxides and quaternary ammonium compounds. If these "surface disinfecting agents" get on the plant or are directly applied to the plant, this always entails irreversible damage to the plant. This means that such disinfecting agents can only be used on working surfaces, positioning surfaces and devices such as, e.g., knives and the like. The surfaces must be freed thereafter from adhering remnants of active substances in order not to endanger the plants during subsequent working steps. However, a sufficient inactivation is not even assured on surfaces since these agents always exhibit significant gaps in their activity against phytopathogenic organisms.

German Published Patent Applications (Offenlegungsschriften) DE 32 27 126 and DE 32 29 097 teach that certain combinations of anionic surfactants, aliphatic and aromatic carboxylic acids, as well as a few heteroaromatic acids, are capable of comprehensively killing off or inactivating viruses, bacteria and fungi without gaps in their activity.

The microbes tested according to the above-cited published applications and patents were primarily human-pathogenic organisms with a low infectiousness like those recommended as test microbes by, among others, the German Society For Hygiene And Microbiology (DGHM) and the German Society For Veterinary Medicine (DVG).

The application of the teaching to highly infectious and resistant phytopathogenic organisms displayed a microbicidal and virus-inactivating activity that was just as persevering as had already been shown to be the case with the human-pathogenic test germs.

However, further tests for plant compatibility with the same agents regularly resulted in a damaging of the test plants in the form of severe scorching, so that the use on plants appeared to be excluded.

It is known from European Patent 91,213 that powdery pesticides against insects or nematodes can be produced that contain a liquid insecticide or nematocide and certain glycols such as ethylene, glycol, propylene glycol, triethylene glycol, glycerol or certain polyethylene glycols and similar compounds as well as an inert, solid carrier, are used for dusting seeds and are not phytotoxic.

It surprisingly was found that the use of certain acid-surfactant-combinations in the presence of glycols overcomes the previous deficiency in the combating of phytopathogenic organisms, and that, when applied directly onto a plant, they retain a pronounced bactericidal, fungicidal and viricidal activity and do not damage the plant cells (roots, stems, leaves, flowers and fruit) in the application concentration.

The present invention relates to agents for treating plants and their environment with the goal of killing off phytopathogenic bacteria, fungi, viruses and viroids and of hindering their spread. Even pathogens (e.g., viruses) that are already on plants can be killed off or inactivated by these agents by moistening roots, stems, leaves and flowers without damaging the plant cells. The biological behavior of the plant also is not altered by the treatment. Working areas in the vicinity of the plants (e.g., tables, knives, positioning surfaces) that could cause a

contamination are also freed in a long-lasting manner of noxious organisms therewith without phytotoxic residues having to be subsequently removed.

The invention provides a disinfecting agent for combating and inactivating phytopathogenic organisms that are present on plants and on surfaces surrounding the plants, the agent, when contacted with phytopathogenic organisms present on plants or on surfaces in the vicinity of the plants, kills or inactivates the phytopathogenic organisms without damaging the plants and without leaving phytotoxic residues on those surfaces. The agent comprises at least one anionic surfactant, at least one aliphatic carboxylic acid, at least one aromatic carboxylic acid, mono-, di- and/or triglycols, at least one hydrotropic agent, and at least one primary and/or secondary aliphatic monovalent alcohol having a chain length of C<sub>2</sub> to C<sub>8</sub> in aqueous solution.

The aliphatic carboxylic acid or acids is/are selected from methanoic acid, ethanoic acid, propanoic acid, hydroxyethanoic acid, 2-hydroxypropionic acid, oxoethanoic acid, 2-oxopropionic acid or 4-oxovaleric acid, or a mixture thereof, and the aromatic carboxylic acid or acids is/are selected from benzoic acid, o-, m-, p-hydroxybenzoic acid or 3,4,5-tri-hydroxybenzoic acid, or a mixture thereof. The anionic surfactant has a primary chain length of C<sub>8</sub> - C<sub>18</sub> and is selected from an alkyl sulfonate, an alkylarylsulfonate or a sodium, potassium or ammonium salt of an alkyl sulfonate or an alkylarylsulfonate, or a mixture thereof. The mono-, di- and/or tri-glycols are selected from ethylene glycol, propylene glycol, 2,3-butylene glycol, diethylene glycol or triethylene glycol, or a mixture thereof; and the hydrotropic agent is toluene sulfonate and/or cumene sulfonate, as a sodium or potassium salt, or a mixture thereof.

The invention is further described in more detail in the following specific examples, which are included to provide a better understanding of the invention, but without limitation.

## EXAMPLE 1

<u>Components</u>	<u>Parts by weight (%)</u>
Alkylarylsulfonate potassium	8.5 % by wt.
Propanediol-1,2	20.5
Toluene sulfonate potassium	10.0
p-Hydroxybenzoic acid	6.9
Hydroxyethanoic acid	3.8
Propanol-2	28.0
Water (desalinated)	18.5

## EXAMPLE 2

<u>Components</u>	<u>Parts by weight (%)</u>
Alkylsulfonate potassium	10.0 % by wt.
Ethandiol-1,2	15.0
Cumene sulfonate potassium	10.0
p-Hydroxybenzoic acid	6.9
Oxoethanoic acid	7.0
Propanol-1	15.0
Propanol-2	15.0
Water (desalinated)	18.5

## EXAMPLE 3

<u>Components</u>	<u>Parts by weight (%)</u>
Alkylarylsulfonate potassium	12.0 % by wt.
Ethandiol-1,2	18.0
Cumene sulfonate potassium	8.0
Benzoic acid	7.0
2-Hydroxypropionic acid	7.0
Propanol-1	20.0
Propanol-2	15.0

5

Water (desalinated)	13.0
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## EXAMPLE 4

<u>Components</u>	<u>Parts by weight (%)</u>
Alkylsulfonate (C <sub>8</sub> -C <sub>18</sub> ) potassium	7.0 % by wt.
Alkylsulfonate (C <sub>12</sub> ) potassium	3.0
Ethenediol-1,2	12.0
Cumene sulfonate potassium	11.5
Benzoic acid	9.0
2-Hydroxyethanoic acid	4.5
Propanol-1	15.0
Propanol-2	15.0
Water (desalinated)	23.0

## EXAMPLE 5

<u>Components</u>	<u>Parts by weight (%)</u>
Alkylarylsulfonate sodium	12.0 % by wt.
Cumene sulfonate sodium	8.5
o-Hydroxybenzoic acid	9.5
2-Hydroxypropionic acid	5.0
Propanol-1	22.0
Propanol-2	20.0
Water (desalinated)	23.5

Bactericidal activity on a plant (biotest)

(A) Young plant pelargoniums and begonias were contaminated by spraying with *Xanthomonas campestris*. A leaf surface of 1 cm<sup>2</sup> had 10<sup>4</sup> KBE after the contamination.

A treatment with Example 4 in concentrations of 1.0 %, 2.0 % and 3.0 % was conducted, also with a spraying method, one hour after the inoculation.

Specimens were taken one hour after the treatment. The germs of the treated and of the untreated controls (without Example 4) were removed from the leaves by ultrasound (wash liquid of 0°C) and their number determined.

(B) Pelargoniums and begonias were treated by spraying with Example 4.

The contamination with *Xanthomonas campestris* took place, also with a spraying method, 24 hours after the treatment with Example 4.

Specimens were taken one hour after the contamination. The germs of the treated and of the untreated controls (without Example 4) were removed from the leaves by ultrasound (wash liquid of 0°C) and their number determined.

Scorching, lesions on the leaf edges and the leaf blades, germ reduction and leaf compatibility are cited in the following table:

		Pelargoniums		Begonias	
A	Concentration	Germ reduction	Toxic phenomena on leaves	Germ reduction	Toxic phenomena on leaves
	1.0% Example 4	97%;93%	No lesions	<99%	No lesions
	2.0% Example 4	100%;99.5 %	No lesions	99.9%	No lesions
	3.0% Example 4	100%;99.9 %	A few leaf edge lesions	99.9%	Slight lesions on leaf edges
	1.0% Example 5	98%;95%	Lesions on the leaf edges	99.5%; 99.7%	Lesions on the leaf edges and leaf blades
	2.0% Example 5	100%;100 %	Lesions on the leaf edges and leaf blades	99.9%;99.9 %	Scorching on the leaf edges and the leaf blades
	3.0% Example 5	100%;94%	Many lesions on the leaf edges and leaf blades	100%;100%	Scorching on the leaf edges and the leaf blades
B	1.0% Example 4	98%	No lesions	95%	No lesions

Plant compatibility

Maximal tolerable concentrations of formulation Examples 2, 4 and 5 on plant organs:

Examples	Plant organ	Phalaenopsis <sup>1</sup>		
		Damage	BR	BS
1.0 % Example 2	Flowers	0		
2.0 % Example 2		0		
3.0 % Example 2		0		
1.0 % Example 2	Leaves	0	0	0
2.0 % Example 2		0	0	0
3.0 % Example 2		+	+	0
1.0 % Example 4	Flowers	0		
2.0 % Example 4		0		
3.0 % Example 4		0		
1.0 % Example 4	Leaves	0	0	0
2.0 % Example 4		0	0	0
3.0 % example 4		+	++	0
1.0 % Example 5	Flowers	++		
2.0 % Example 5		++		
3.0 % Example 5		+++	+++	+++
1.0 % Example 5	Leaves	+	++	++
2.0 % Example 5		++	+++	++
3.0 % Example 5		+++	+++	+++

<sup>1</sup>orchid type

BR = leaf edges

BS = leaf blades

+++ = very many / very heavily damaged

++ = many / heavily damaged

+ = few / slightly damaged

0 = none / not damaged

The test for a sufficient inactivation of phytopathogenic organisms gave the following results:

(1) Bactericidal action of Examples 1 - 5 in a lab test according to "Guideline 16-4 For The Testing Of Plant Protection Products For Disinfection In The Cultivation Of Decorative Plants" of the Biological Federal Institute for Agriculture and Forestry (Braunschweig, 1986)

Required contact times of Examples 1 - 5 for killing off the indicated bacterial strains:

Examples	Xanthomonas pelargonii	Pseudomonas solanaceum	Erwinia amylovora
Tap water control	No activity	No activity	No activity
1.0% Example 1	1 min.	1 min.	5 min.
1.0% Example 2	1 min.	1 min.	1 min.
1.0% Example 3	5 min.	5 min.	15 min.
1.0% Example 4	1 min.	1 min.	1 min.
1.0% Example 5	1 min.	1 min.	1 min.

(2). Fungicidal action of Examples 1- 5 in a lab test according to "Guideline 16-4 For The Testing Of Plant Protection Products For Disinfection In The Cultivation Of Decorative Plants" of the Biological Federal Institute For Agriculture And Forestry (Braunschweig, 1986).

Required contact times of Examples 1-5 for killing off the indicated fungus test strains:

Example	Fusarium oxysporum	Thielaviopsis basicola	Phytophthora sp	Cylindrocladium scoparium
Tap water control	No activity	No activity	No activity	No activity
1.0% Example 1	16 h	> 16 h	1 h	> 16 h
2.0% Example 1	4 h	4 h	1 h	> 16 h
1.0% Example 2	4 h	4 h	1 h	> 16 h
2.0% Example 2	1 h	1 h	5 min	16 h
1.0% Example 3	4 h	16 h	1 h	16 h
2.0% Example 3	4 h	4 h	30 min	4 h
1.0% Example 4	1 h	4 h	30 min	16 h
2.0% Example 4	1 h	1 h	15 min	4 h
1.0% Example 5	1 h	4 h	1 h	16 h
2.0% Example 5	1 h	1 h	5 min	16 h

Required contact times of Examples 1-5 for inactivating the indicated viral strains (suspension test):

Disinfecting agent	TMV	PBY	PFBV	CNV	ORSV	PSTVd
Tap water control	No activity	No activity	No activity	No activity	No activity	No activity
1.0% Example 1	16 h	16 h	4 h	16 h	4 h	4 h
2.0% Example 1	16 h	4 h	1 h	4 h	1 h	1 h
3.0% Example 1	16 h	4 h	1 h	4 h	1 h	<1 h
1.0% Example 2	>16 h	16 h	4 h	16 h	1 h	4 h
2.0% Example 2	16 h	4 h	1 h	4 h	<1 h	1 h
3.0% Example 2	4 h	4 h	1 h	4 h	<1 h	1 h
1.0% Example 3	>16 h	16 h	4 h	1 h	4 h	4 h
2.0% Example 3	16 h	4 h	1 h	<1 h	4 h	1 h
3.0% Example 3	16 h	4 h	1 h	<1 h	1 h	1 h
1.0% Example 4	4 h	4 h	1 h	<1 h	4 h	1 h
2.0% Example 4	4 h	1 h	<1 h	<1 h	1 h	<1 h
3.0% Example 4	1 h	1 h	<1 h	<1 h	1 h	<1 h
1.0% Example 5	4 h	4 h	1 h	<1 h	4 h	1 h
2.0% Example 5	4 h	4 h	1 h	<1 h	1 h	1 h
3.0% Example 5	1 h	1 h	<1 h	<1 h	1 h	<1 h

TMV =	Tobacco mosaic virus
PVY =	Potato virus Y Potyvirus
PFBV =	Pelargonium flower break carmovirus
CNV =	Cucumber necrosis tombuvirus
ORSV =	Odontoglossum ringspot virus
PSTVd =	Potato spindle tuber viroid

The test for a sufficient inactivation of phytopathogenic organisms gave the following results:

(1) Bactericidal action of Examples 1-5 in a lab test according to "Guideline 16-4 For The Testing Of Plant Protection Products For Disinfection In The Cultivation Of Decorative Plants" of the Biological Federal Institute For Agriculture And Forestry (Braunschweig, 1986)

Required contact times of Examples 1-5 for killing off the indicated bacterial strains:

Examples	Xanthomonas pelargonii	Pseudomonas solanaceum	Erwinia amylovora
Tap water control	No activity	No activity	No activity
1.0% Example 1	1 min.	1 min.	5 min.
1.0% Example 2	1 min.	1 min.	1 min.
1.0% Example 3	5 min.	5 min.	15 min.
1.0% Example 4	1 min.	1 min.	1 min.
1.0% Example 5	1 min.	1 min.	1 min.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A disinfecting agent for combating and inactivating phytopathogenic organisms that are present on plants and on surfaces surrounding the plants, the agent, when contacted with phytopathogenic organisms present on plants or on surfaces in the vicinity of the plants, kills or inactivates the phytopathogenic organisms without damaging the plants and without leaving phytotoxic residues on those surfaces; the agent comprising at least one anionic surfactant, at least one aliphatic carboxylic acid (A), at least one aromatic carboxylic acid (B), at least one mono-, di- or tri-glycol, at least one hydrotropic agent, and at least one primary and/or secondary aliphatic monovalent alcohol having a chain length of C<sub>2</sub> to C<sub>8</sub> in aqueous solution, and wherein:

the aliphatic carboxylic acid is methanoic acid, ethanoic acid, propanoic acid, hydroxyethanoic acid, 2-hydroxypropionic acid, oxoethanoic acid, 2-oxopropionic acid or 4-oxovaleric acid, or a mixture thereof, and the aromatic carboxylic acid is benzoic acid, o-, m-, p-hydroxybenzoic acid, or 3,4,5-tri-hydroxybenzoic acid, or a mixture thereof;

the anionic surfactant has a primary chain length of C<sub>8</sub> - C<sub>18</sub> and is an alkyl sulfonate, an alkylarylsulfonate, or a sodium, potassium or ammonium salt of an alkyl sulfonate or an alkylarylsulfonate, or a mixture thereof (C);

the mono-, di- or tri-glycol is ethylene glycol, propylene glycol, 2,3-butylene glycol, diethylene glycol or triethylene glycol, or a mixture thereof; and

the hydrotropic agent is toluene sulfonate or cumene sulfonate, as a sodium or potassium salt, or a mixture thereof.

2. A disinfecting agent according to claim 1, wherein the weight ratio of the aliphatic carboxylic acid or acids (A) to the aromatic carboxylic acid or acids (B) is between 1 : 9 and 9 : 1, and the total weight of aliphatic acids plus aromatic

acids is between 5 and 40 % by wt. relative to the total weight of the disinfecting agent.

3. A disinfecting agent according to claim 1 or 2, wherein the weight ratio of the weight of the alkyl sulfonates and/or alkylarylsulfonates and/or their salts (C) with the weight of the carboxylic acids (A+B), in the ratio  $C : (B+A)$ , is between 1 : 9 and 9 : 1, and the weight of the alkyl and/or aryl sulfonates and/or salts thereof is between 10 and 60 % by wt. relative to the total weight of the disinfecting agent.

4. A disinfecting agent according to claim 1, 2 or 3, wherein the weight component of the glycol or glycols relative to the total weight of the disinfecting agent is between 10 and 40 % by wt.

5. A disinfecting agent according to any one of claims 1 to 4, wherein the weight of the hydrotropic agent or agents toluene sulfonate and/or cumene sulfonate, and/or their sodium or potassium salts, individually or in a mixture with each other, is between 5 and 40 % by wt. relative to the total weight of the disinfecting agent.

6. A disinfecting agent according to any one of claims 1 to 5, wherein the weight of the monovalent alcohols, individually or in a mixture with each other, is between 5 and 60 % by wt. relative to the total weight of the disinfecting agent.

7. Use of a disinfecting agent according to any one of claims 1 to 6, for combating phytopathogenic microorganisms on a plant or on a surface in the vicinity of the plant, in a concentration of 0.5 to 10 % by wt. of the disinfecting agent in a diluted aqueous solution.

8. A method for combating phytopathogenic microorganisms present on a plant or on surfaces surrounding the plant, comprising the step of applying to the plant and/or to its immediate environment a composition containing 0.5 to 10 % by wt. of a disinfecting agent as defined in any one of claims 1 to 6, in dilute aqueous solution.