

Stabilized aqueous pesticidal suspension
concentrate.

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1 TECHNICAL FIELD

The present invention relates to a stabilized aqueous pesticidal suspension concentrate. More particularly, the invention pertains to an aqueous pesticidal suspension concentrate which is capable of retaining uniform dispersibility for a long time and suited for not only usual-concentration ground application but also high-concentration applications such as aerial application [ULV application (ultra low volume application), LV application (low volume application) or S application (Spray application)] and can be also used in admixture with other emulsifiable concentrates even for such high-concentration applications, owing to the blending of a specific surfactant and heteropolysaccharide which is a water soluble thickner.

15 DESCRIPTION OF THE PRIOR ART

Dusts, granules, wettable powders and emulsifiable concentrates are known as the typical preparation forms of agricultural chemicals. Among these preparation forms, dusts have the problem of much drifting to the environs at the time of application. Wettable powders are subject to heavy dusting at the time of preparation of a liquid spray because such wettable powders are composed of fine particles, and thus they pose the problem of injurious effects to the human body. Emulsifiable concentrates have the disadvantages

1 that the types of the raw material pesticides which can be
used as an emulsion are limited because such raw material
pesticides are required to be easily dissoluble in organic
solvents, that the preparations are unsafe and have a risk
5 of causing a fire or other disasters during storage because
of use of organic solvents, and that the application of such
emulsifiable concentrates may cause damage to certain types
of crops.

Recently, aerial application (ultra low volume
10 application, low volume application or spray application)
has become popular for saving time and labor in application
works of agricultural chemicals. However, the conventional
preparation forms of agricultural chemicals are not always
suited for such aerial application and therefore the
15 development of a new preparation form suited for aerial
application has been desired. As a preparation suited for
aerial application, there are known the suspension con-
centrates prepared by suspending the fine particles of water-
insoluble or only slightly water-soluble technical grade
20 pesticides in water or a hydrophilic solvent by adding an
emulsifying agent and a dispersing agent.

These known suspension concentrates, however, are
poor in long-term physical stability. Also, when they are
used in admixture with other pesticidal emulsions for aerial
25 application which is a type of high concentration application,
there could take place flocculation of the suspended particles
and the flocculates would be separated and sedimented to
cause clogging of the strainer of the applicator adapted to

1 a helicopter, etc. Further, such flocculates could
induce phytotoxicity to the crops to which they adhere in
the course of application of the mixed pesticidal prepara-
tion. Thus, these conventional preparations lacked the
5 properties required of a suspension concentrate for aerial
application.

Japanese Patent Laid-Open 129201/80, Japanese
Patent Publication 24401/83 and Japanese Patent Laid-Open
124702/83 disclose the techniques relating to the suspension
10 concentrates. However, the preparation disclosed in Japanese
Patent Laid-Open 129201/80 has difficulties in achieving
sufficient wetting and uniform suspension of the sparingly
water soluble or water-insoluble active ingredient (technical
grade pesticide) in water. Also, when such preparation
15 is used in admixture with other known pesticidal emulsions,
flocculates tend to be produced to cause clogging of the
strainer in the applicator.

The suspension concentrate disclosed in Japanese
Patent Publication 24401/83 is poor in long-term storage
20 stability because of low yield value. The preparation
disclosed in Japanese Patent Laid-Open 124702/83 can not be
used in admixture with other technical grade pesticidal
preparations. For controlling the insects which breed in
the same season, it is commonly practiced to mix a pesticidal
25 preparation with other preparation(s) on the spot and apply
the mixed preparation for saving time and labor for such
application. However, the conventional suspension con-
centrates, when used in admixture with other preparation(s),

- 1 tend to form creamy flocculates which cause clogging of
the strainer in the applicator.

SUMMARY OF THE INVENTION

An object of the present invention is to provide
5 a stabilized aqueous pesticidal suspension concentrate.

The present invention was attained as a result of
the assiduous studies by the present inventors for overcoming
the said problems of the conventional aqueous pesticidal
preparations. Thus, the present invention provides an
10 aqueous pesticidal suspension concentrate using as active
ingredient at least one pesticidal preparation which is
solid at normal temperature and only sparingly soluble or
insoluble in water and which can be uniformly and stably
suspended in water, said pesticidal suspension concentrate
15 being easy to treat, excellent in storage stability, suspen-
sibility and dispersibility at the time of application,
capable of aerial application and also usable in admixture
with other technical grade pesticidal emulsions. These
prominent advantages of the preparation of this invention
20 owe to the blending of a surfactant and heteropolysaccharide
which is a water-soluble thickner.

BRIEF DESCRIPTION OF THE INVENTION

An aqueous pesticidal suspension concentrate
provided according to the present invention comprises
25 essentially 50% by weight or less of at least one pesticide
used as active ingredient which is solid at normal

1 temperature and only sparingly soluble or insoluble in
water, 0.1 to 5.0% by weight of an alkylphenol polyglycol
ether used as surfactant, 0.1 to 5.0% by weight of a non-
ionic surfactant having an alkyl or aralkenyl substituted
5 aromatic ring as oleophilic group, and heteropolysaccharide,
a water-soluble thickner, which is added in a sufficient
amount so that the preparation will have a yield value of
10 dyne/cm² or above at 25°C. The present aqueous pesticidal
suspension concentrate is also typified by the fact that
10 it can be used in admixture with other emulsifiable
pesticides.

A stabilized aqueous pesticidal suspension concentrate according to the present invention can be used not only for usual agricultural applications but also for
15 wood preservative treatments in order to control brown-rot fungi, such as Coniophova puteana, Serpula lacrymans, Tyromyces palustris or the like; white-rot fungi, such as Coriolus versicolor or the like; and soft-rot fungi, such as Chaetomium or the like by treating the wood portions or
20 the soil portions of the plants with the suspension concentrate. Furthermore, the suspension concentrate of the present invention can also be used for controlling phytotoxicities in lawns and grazing grounds caused by rust (Puccinia spp.), Rhizoctonia solani Kühn and the like.

25 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

All types of known pesticidal preparations which are solid at normal temperature and only sparingly soluble

1 or insoluble in water can be used as active ingredients
for the composition of the present invention. Examples
of such pesticidal preparations include fungicides such as
di-isopropyl 1,3-dithiolan-2-ylidenemalonate (known by the
5 general name of Isoprothiolane), 3'-isopropoxy-2-trifluoro-
toluanilide (known by the general name of Flutolanil), 3'-
isopropoxy-2-toluanilide (known by the general name of
Mepronil), and 4,5,6,7-tetrachlorophthalide (known by the
general name of Phthalide); insecticides such as 2-t-butyl-
10 imino-3-isopropyl-5-phenyl-3,4,5,6-tetrahydro-2H-1,3,5-
thiadiazin-4-one (known by the general name of Buprofezin)
and m-tolyl N-methylcarbamate (known by the general name
of MTMC); and herbicides such as 2-chloro-4,6-bis(ethyl-
amino)-1,3,5-triazine (known by the general name of CAT)
15 and 2-chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine
(known by the general name of Atrazine). The above-
mentioned are merely exemplary and other similar pesticidal
preparations can as well be used as active ingredients for
the aqueous pesticidal suspension concentrate of the present
20 invention.

These pesticidal preparations serving as active
ingredients can be used either singly or in admixture in
an amount of 50% by weight or less, preferably 10 to 50%
by weight based on the total weight of the composition.

25 A typical example of alkylphenol polyglycol ether
used in this invention is nonylphenol polyglycol ether, and
such ether is used in an amount of 0.1 to 50% by weight,
preferably 0.1 to 3% by weight.

1 As to the non-ionic surfactant having an alkyl or
aralkenyl substituted aromatic ring as oleophilic group,
there can be used one or more substances selected from
formaldehyde condensates of alkylphenol polyglycol ethers
5 and styrylphenol polyglycol ethers. These surfactants can
be used either singly or in admixture. The amount of the
non-ionic surfactant to be blended can be suitably selected
from within the range of 0.1 to 5.0% by weight.

Heteropolysaccharide is used in this invention as
10 a water soluble thickner. This polysaccharide, generally
called Xanthan gum, is a high-molecular weight linear extra-
cellular substance produced by the action of bacteria
belonging to the genus Xanthomonas. This substance, for
use in the present invention, should have a molecular weight
15 exceeding 200,000, preferably over 1,000,000. It is used
in such an amount that the produced pesticidal suspension
concentrate will have a yield value of 10 dyne/cm² or above
at 25°C, and usually the preferred amount range thereof is
from 0.05 to 0.5% by weight.

20 Water is basically used as the solvent in the
preparation of the aqueous pesticidal suspension concentrate
according to the present invention. Water alone may be
used, and if necessary it is possible to blend one or more
organic solvents selected from the hydrophilic solvents
25 such as methyl alcohol, ethyl alcohol, isopropyl alcohol,
polyethylene glycol, ethylene glycol, propylene glycol, etc.,
and in some cases the hydrophobic solvents such as xylene,
toluene, kerosene, mineral oils, vegetable oils, liquid

1 paraffin, etc. Such organic solvent(s), when used, is(are)
blended in an amount of 1 to 30% by weight, preferably 10
to 20% by weight.

The aqueous pesticidal suspension concentrate of
5 the present invention may contain where necessary other
substances than the above-said ingredients, for example a
defoaming agent such as a silicone-based defoaming agent
mainly composed of dimethyl polysiloxane in an amount not
exceeding 5% by weight. It is also possible to blend
10 hydrophilic silica or the like as a milling assistant for the
technical grade material in an amount not greater than 5% by
weight, as well as other substances required for the intended
preparation. Other technical grade pesticides that can be
used in admixture with the aqueous pesticidal suspension
15 concentrate of the present invention include MEP emulsion,
BPMC emulsion, MEP-BPMC emulsion, Diazinon emulsion, PAP
emulsion, Isopropthiolane emulsion, Malathon emulsion, IBP
emulsion and the like.

The aqueous pesticidal suspension concentrate
20 according to the present invention can be prepared, for
example, as follows. Predetermined amounts of an alkylphenol
polyglycol ether, a non-ionic surfactant and if necessary
a defoaming agent and an organic solvent (or solvents) are
suspended or dissolved in water by a stirrer. Then the active
25 ingredient is added thereto and the mixture is milled by
a wet-milling equipment so that the particle size of the
active ingredient will become 5 μm or less, preferably 0.5
to 3.0 μm . Then a predetermined amount of heteropoly-

- 1 saccharide is added to the mixture, followed by further mixing to obtain a homogeneous preparation.

The embodying examples of the present invention and some test examples are shown below. In the following
5 descriptions of the examples, all "parts" are by weight unless otherwise noted.

Example 1

Materials used:

Buprofezin	42.00 parts
Nonylphenol polyglycol ether (10 EO)	1.40 parts
Styrylphenol polyglycol ether (24 EO)	2.00 parts
Propylene glycol	3.00 parts
Defoaming agent	0.50 part
Heteropolysaccharide	0.15 part
Hydrophilic silica	3.00 parts
Water	47.95 parts

- 1.40 Parts of nonylphenol polyglycol ether (10 EO),
10 2.00 parts of styrylphenol polyglycol ether (24 EO), 3.00 parts of propylene glycol and 0.50 part of defoaming agent (Silicone KM-73 produced by The Shin-Etsu Chemical Co., Ltd.) were added to 47.95 parts of water and they were dissolved and mixed for 20 minutes by an ordinary stirrer (Homomixer
15 Model HV-M manufactured by Tokushukika Kogyo Co., Ltd.). Then 42.0 parts of Buprofezin and 3.00 parts of hydrophilic silica (Carplex #80 manufactured by Shionogi & Co., Ltd.) were added and the mixture was milled for 3 hours by a wet-

1 milling equipment (Attritor manufactured by Mitsui Miike Machinery Co., Ltd.). Finally, 0.15 part of heteropoly-saccharide was added, followed by mixing for 20 minutes to obtain 100 parts of a homogeneous preparation.

5 In the same way, there were obtained the preparations of Examples 2-9, Referential Examples 1-10, Examples 10-12 and Referential Examples 11-15. The formulations for these preparations are shown in Tables 1, 2 and 3.

Table 2

	Referential Examples						
	1	2	3	4	5	6	7
Buprofezin	42.00	42.00	42.00	42.00	42.00	42.00	42.00
Nonylphenol polyglycol ether (10 EO)	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Formaldehyde condensate of naphthalenesulfonic acid	2.00	-	-	-	-	-	-
Calcium lignosulfonate	-	2.00	-	-	-	-	-
Polyvinyl alcohol	-	-	2.00	-	-	-	-
Styrylphenol polyglycol ether (24 EO)	-	-	-	0.80	0.80	0.80	0.80
Formaldehyde condensate of nonyl-phenol polyglycol ether (30 EO)	-	-	-	1.20	1.20	1.20	1.20
Propylene glycol	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Dimethyl polysiloxane (KM-73)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Heteropolysaccharide	0.15	0.15	0.15	-	-	-	-
Sodium alginate	-	-	-	-	0.12	0.18	-
Carboxymethyl cellulose	-	-	-	-	-	-	0.12
Hydroxypropylmethyl cellulose	-	-	-	-	-	-	-
Hydrophilic silica (Carplex)	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Water	47.95	47.95	47.95	48.10	47.98	47.82	47.98
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

- Cont'd -

Table 2 (Cont'd)

Referential Examples		
8	9	10
42.00	42.00	42.00
1.40	1.40	1.40
-	-	-
-	-	-
-	-	-
0.80	0.80	0.80
1.20	1.20	1.20
3.00	3.00	3.00
0.50	0.50	0.50
-	-	-
-	-	-
0.18	-	-
-	0.12	0.18
3.00	3.00	3.00
47.92	47.98	47.92
100.00	100.00	100.00

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[illegible]

1 Test Example 1

The viscosity (apparent viscosity and yield value) and physical stability (sediment volume ratio) of the preparations obtained in the respective Examples and Referential

5 Examples were determined in the following ways.

Viscosity:

Measured by using an E type viscometer (mfd. by Tokyo Keiki Ltd.), maintaining the specimen temperature at 25°C. Cone: 1'34". Apparent viscosity is the viscosity
10 at a shear rate of 100 sec⁻¹. Yield value was represented by shear stress at a shear rate of 0 sec⁻¹.

Sediment volume ratio:

20 ml of each preparation according to this invention or each comparative preparation is put into a graduated
15 measuring cylinder with ground stopper having an inner diameter of 1.3 cm and a volume of 20 ml, and this cylinder is left stationary in a 40°C thermostatic chamber for one month. The volume V (ml) occupied by the sedimented particles is measured, and its ratio to
20 the total volume is determined from the following equation. The obtained value was given as an index of the physical stability of the preparation.

$$\text{Sediment volume ratio} = \frac{V}{20} \times 100$$

The results are shown in Table 4.

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Table 4

	Aqueous pesticidal suspension concentrate tested	Apparent viscosity c.p.s.	Yield value dyne/cm ²	Sediment volume ratio
The present inven- tion	Example 1	265	38	100
	" 2	265	40	100
	" 3	265	43	100
	" 4	130	14	99
	" 5	160	21	99
	" 6	210	28	100
	" 7	250	46	100
	" 8	280	58	100
	" 9	320	62	100
	" 10	192	13	89
	" 11	210	21	99
	" 12	185	30	100
Control	Referential Example 4	92	0	66
	" 5	248	0	85
	" 6	432	0	85
	" 7	260	0	78
	" 8	216	0	75
	" 9	50	0	73
	" 10	55	0	73
	" 13	20	0	60
	" 14	230	0	60
	" 15	280	0	60

1 Test Example 2 (Mixing test)

Water was put into a 500 ml wide-mouthed bottle and then a determined amount of a commercially sold pesticidal emulsion was put thereinto, followed by sufficient stirring to effect uniform emulsification and dispersion. Thereafter, a determined amount of each specimen of aqueous pesticidal suspension concentrate according to this invention was added and dispersed uniformly to form a mixed liquid pesticidal preparation diluted to a concentration suited for LV (low volume) application (8 litres per hectare). Similar mixtures were prepared in the same way by using the control specimens (Referential Examples). These mixed liquid preparations were left still for 2 hours and then passed through a 250-mesh strainer. Whether the specimen tested can be used in admixture with a commercial emulsified pesticide or not was judged from the amount and state of the residue on the strainer. The results are shown in Table 5. In Table 5, o indicates that there was no residue on the strainer and the specimen can be used in admixture with a commercial liquid pesticide, and x indicates that there remained creamy residue on the strainer and the specimen can not be used in admixture with a commercial liquid pesticide.

CLAIMS

1. A stabilized aqueous pesticidal suspension concentrate, for use in admixture with other emulsifiable pesticides, comprising 50% by weight or less of one or
5 more pesticides which are solid at normal temperature and only sparingly soluble or insoluble in water, 0.1 to 5.0% by weight of an alkylphenol polyglycol ether, 0.1 to 5.0% by weight of a non-ionic surfactant having an
10 alkyl or aralkenyl substituted aromatic ring as oleophilic group, and heteropolysaccharide used as water soluble thickener in a sufficient amount so that the produced preparation will have a yield value of 10 dyne/cm² or above at 25°C.
2. A stabilized aqueous pesticidal suspension concentrate according to claim 1, wherein said non-ionic
15 surfactant having an alkyl or aralkenyl substituted aromatic ring as oleophilic group is at least one member selected from the group consisting of formaldehyde condensates of alkylphenol polyglycol ethers and
20 styrylphenol polyglycol ethers.
3. A stabilised aqueous pesticidal suspension concentrate, substantially as hereinbefore described with reference to Examples 1 to 12.

