

The present invention relates to non-aqueous-based liquid pesticide concentrates which are sealed in a bag made from a water-soluble film.

Pesticides are normally marketed in the form of concentrates which, before use, are diluted with water to form spray mixtures. Because of the toxicity of the active ingredients, steps are necessary to prevent the user from coming into contact with the concentrates when handling them. In particular, the user must be protected from inhaling the dust arising from handling solid formulations, such as powders and granules, and from skin contact with liquid formulations, such as emulsifiable concentrates. The manufacturers of pesticide concentrates therefore emphatically recommend taking a number of precautions, such as wearing protective masks, suits and gloves.

To provide further improved protection for the user, the proposal has already been made to avoid the dust formation associated with handling solid pesticide concentrates and skin contact with liquid concentrates by packaging these concentrates in a bag made from a water-soluble film. The spray mixture is prepared from such concentrates packed in water-soluble material by putting the concentrate and its packaging into the amount of water necessary for preparing the spray mixture. The spray mixture forms immediately after dissolution of the packaging and dispersion of the contents. Direct contact of the user with the concentrate is thereby avoided.

Moreover, packaging concentrates in water-soluble packaging materials has the advantage that the concentrates can be removed from the containers, in which they are transported and stored to protect them from moisture, without leaving any residues which would make it necessary to clean the containers. In addition, it is

much easier to control the dosage of the active ingredient, because each bag contains a defined amount of active ingredient.

The water-soluble packages of liquid active ingredient concentrates of the prior art have, however, a relatively high sensitivity to shock and impact, so that, when subjected to sudden mechanical stress, for example on falling to the ground, they burst. Not only do these unfavourable properties lead, in the transportation and handling of such packages, to repeated losses and to contamination of the environment and/or of the user, but also the advantages associated with the use of water-soluble packaging materials referred to above are lost.

GB-B-922 317 describes solid or liquid and especially water-soluble pesticides that in addition contain a wetting agent and that are packed in a water-soluble film.

Chem. pat. ind., Basic Abstracts J., Woche 8739, 25.11.87, Abstract No. 87-274684/39 describes solidified gels packed in a water-soluble film, which quite clearly are not concentrates, from which an application form must first be prepared.

Hence it is the object of this invention to provide pesticide concentrates in packaged form that comprise a water-soluble package and a liquid, non-aqueous pesticide concentrate, and that have increased stability to impact and shock.

There are proposed in accordance with the invention pesticide concentrates in packaged form comprising a water-soluble package and a liquid, non-aqueous pesticide concentrate, wherein the concentrate comprises one or

more water-insoluble active ingredients, a solvent that is inert towards the water-soluble packaging material, a viscosity-increasing additive and one or more dispersants, and wherein the viscosity of the liquid pesticide concentrate is 1000-20 000 cp.

In the simplest case, the pesticide concentrates of this invention are solutions of one or more active ingredients in a non-aqueous solvent, the viscosity of which concentrates has been adjusted to 1000-20 000 cp by the addition of a viscosity-increasing substance. The pesticide concentrates according to the invention may also, however, be solutions of one or more active ingredients in a non-aqueous solvent, in which additionally one or more active ingredients that are insoluble in the solvent used are suspended, the viscosity of which suspensions has also been adjusted to 1000-20 000 cp by the addition of a viscosity-increasing substance. Finally, the concentrates of the invention may also be suspensions of one or more active ingredients in a non-aqueous solvent, the viscosity of which suspensions has been adjusted to 1000-20 000 cp by the addition of a viscosity-increasing substance.

In addition to comprising one or more active ingredients, the solvent and the viscosity-increasing substance, the concentrates of this invention advantageously contain one or more dispersants. The addition of one or more dispersants is especially expedient if the active ingredient and/or the solvent used and/or the viscosity-increasing substance are insoluble in water and it is necessary to form a dispersion after diluting the concentrate with water.

Suitable non-aqueous solvents are solvents generally used in pesticide formulation that are inert to the

water-soluble packaging material, i.e. those solvents in which the water-soluble packaging material neither dissolves nor swells nor is otherwise adversely affected. With respect to this limitation, however, it must be borne in mind that the greater the concentration of the substances dissolved therein the lesser the tendency generally of the solvent to dissolve the packaging material or cause it to swell. Suitable solvents are alcohols, alkanediols (glycols), diethylene glycol monoethers, ketones, esters, aliphatic and aromatic hydrocarbons, as well as mineral and vegetable oils. Particularly suitable alcohols are C₁-C₈alkanols, preferably C₃-C₆alkanols and C₅-C₆cycloalkanols. Particularly suitable alkanediols are ethylene glycol and propylene glycol. Particularly suitable diethylene glycol monoethers are diethylene glycol monomethyl ether and dipropylene glycol monomethyl ether. Particularly suitable ketones are C₄-C₈alkanones and C₅-C₆cycloalkanones. Suitable esters are preferably C₃-C₆alkyl acetates and lactones of C₄-C₅hydroxyalkanecarboxylic acids. Particularly suitable aliphatic and aromatic hydrocarbons are hexane, cyclohexane, toluene, xylene, as well as mixtures of alkylbenzenes as commercially available, for example, under the registered trademarks [®]Solvesso and [®]Shellsol. Particularly suitable mineral oils are higher boiling petroleum fractions. Suitable vegetable oils are castor oil, rape oil, rape oil esters, cotton seed oil and soybean oil. Particularly suitable solvents are cyclohexanol, diacetone alcohol, cyclohexanone, butyrolactone, amyl acetate, toluene, xylene, as well as mixtures of alkylbenzenes having a boiling range of 130-170°C.

Suitable viscosity-increasing substances for the purposes of the present invention are preferably water-soluble polymers and hydrophilic silicic acid. Suitable water-

soluble polymers are cellulose derivatives, proteins (gelatin) and polyvinylpyrrolidone having a molecular weight of 600 000-1000 000. In individual cases it is also possible to use surfactants, such as ethylene oxide-propylene oxide block polymers or dodecylbenzene-sulfonates, as viscosity-increasing substances. Preferred viscosity-increasing substances are cellulose derivatives, such as methyl cellulose, ethyl cellulose, hydroxyethyl cellulose and hydroxypropyl cellulose.

The dispersants which may be used are basically all non-ionic, anionic and cationic dispersants customarily used in the formulation of pesticides. It is preferred to use non-ionic or anionic dispersants or mixtures of non-ionic and anionic dispersants. Particularly suitable non-ionic dispersants are ethylene oxide-propylene oxide block polymers, alkylphenol polyglycol ethers, as well as fatty acid and fatty alcohol polyglycol ethers. Particularly suitable anionic dispersants are salts of alkylbenzenesulfonic acids, for example calcium dodecylbenzenesulfonate, and also salts of mono- and di-phenol polyglycol ether phosphates, as well as salts of mono-phenol polyglycol ether sulfates. Particularly suitable mixtures of anionic and non-ionic dispersants are mixtures of alkylphenol polyglycol ethers and salts of mono- and di-phenol polyglycol ether phosphates.

By water-soluble packaging materials are meant in the context of this invention preferably films made of water-soluble polymers, for example films made of polyvinyl alcohol, polyvinyl pyrrolidone, copolymers of vinyl alcohol and vinyl pyrrolidone, copolymers of vinyl alcohol and vinyl acetate, as well as cellulosic films, for example carboxymethyl cellulose films. Polyvinyl alcohol films are the preferred packaging material.

The active ingredient concentrates of this invention may in principle comprise any agrochemical active ingredient, for example insecticides, acaricides, fungicides, herbicides and plant growth-regulating substances.

The pesticide concentrates of this invention can be prepared by dissolving or suspending one or more active ingredients in a solution of the dispersant in a non-aqueous solvent, and then incorporating the viscosity-increasing substance in the resultant mixture. The preparation of the concentrates can be carried out in a conventional mixing apparatus. If the individual components of the mixture are water-soluble, the addition of dispersant can be dispensed with, for in this case an aqueous solution is obtained directly from the concentrate on dilution with water. If, however, one or more components of the concentrate are water-insoluble, then it is advantageous to add one or more dispersants in order to ensure the rapid and homogeneous dispersion of the components in water on dilution of the concentrate. The concentrate can then immediately be filled in equal portions into bags which can be made in known manner from films consisting of the polymers cited above. After they have been filled with the concentrate, the bags are sealed. The packages so obtained contain a defined amount of active ingredient per packaging unit. The individual bags can then be packed for transportation and storage individually or collectively in containers, for example cardboard, polyethylene, polypropylene or polyvinyl chloride containers, from which they can readily be removed immediately before use.

The packages of this invention are conveniently prepared by continuously feeding a web of water-soluble material 100-300 mm wide and 30-40 μ m thick to a filling machine, in which the web is first welded by a longitudinal seam

to form a tube, which is sealed at its end by a transverse welding seam. After being filled with the desired amount of active ingredient concentrate, the so pre-formed bag is then sealed with a severing welding seam so as to obtain, on the one hand, a ready-for-use bag containing the active ingredient concentrate and, on the other, a new bag preformed from the tubular film into which the next portion of active ingredient concentrate can be filled. The welding seams can be made by heat welding at a temperature of approx. 300°C as well as by pulse welding or high-frequency welding.

The handling and application of the pesticide concentrates of this invention is exceedingly simple. One or more bags are taken from the container and put into a spray tank filled with water in which the bag made of water-soluble packaging material dissolves in a few minutes, and the concentrate disperses in the water to form a spray mixture. Not only are the previously known advantages of water-soluble bags thereby attained, namely avoidance of direct contact of the user with the concentrate, easy metering of the active ingredients without using measuring vessels, and avoidance of contamination of the packaging containers, but, in addition, the mechanical stability of the packages, especially the stability to sudden mechanical stress, is substantially increased in comparison with prior art bags of this kind containing liquid pesticide concentrates. Only by this increase in the stability to sudden mechanical stress does it become possible to utilise fully the advantages resulting from the use of water-soluble packaging material.

The following Examples illustrate the present invention in more detail. A number of typical formulations of pesticide concentrates of this invention are illustrated,

without any restriction of the present invention being thereby implied. Percentages are by weight. The production of the packages of the invention is also described.

Example 1

Propiconazole techn.	62.5 %
calcium dodecylbenzenesulfonate	4.5 %
castor oil polyglycol ether (EO 36)	4.0 %
isooctylphenol polyglycol ether (EO 8)	2.0 %
alkylbenzene C10-C13, to make up viscosity: 11 000 cp	100 %

Example 2

Propiconazole techn.	65.0 %
PO-EO block polymer (80 % EO; $\overline{MW}$: 8550)	4.5 %
castor oil polyglycol ether (EO 36)	8.8 %
sodium diamylsulfosuccinate	4.6 %
n-butanol, to make up viscosity: 5000 cp	100 %

Example 3

Propiconazole techn.	62.5 %
calcium dodecylbenzenesulfonate	3.0 %
isotridecyl alcohol polyglycol ether (EO 6)	3.0 %
EO-PO block polymer (20 % EO; $\overline{MW}$: 5000)	4.0 %
silicone oil	0.2 %
hydroxypropyl cellulose	1.0 %
cyclohexanone, to make up viscosity: 2000 cp	100 %

Example 4

Propiconazole techn.	62.5 %
calcium dodecylbenzenesulfonate	3.0 %
isotridecyl alcohol polyglycol ether (EO 6)	3.0 %
EO-PO block polymer (20 % EO; $\overline{MW}$: 5000)	4.0 %
silicone oil	0.2 %
hydroxypropyl cellulose	1.0 %
dipropylene glycol monomethyl ether, to make up	100 %
viscosity: 2000 cp	

Example 5

Propiconazole techn.	62.5 %
tristyrylphenol polyglycol ether (EO 20)	8.0 %
nonylphenol polyglycol ether (EO 8)	8.0 %
nonylphenyl polyglycol ether (EO 8-10) phosphate	2.0 %
silicone oil	0.2 %
hydroxypropyl cellulose	0.72%
cyclohexanone, to make up	100 %
viscosity: 2400 cp	

Example 6

Penconazole techn.	25.0 %
propylene glycol	7.0 %
isotridecyl alcohol polyglycol ether (EO 6)	3.0 %
calcium dodecylbenzenesulfonate	4.0 %
EO-PO block polymer (20 % EO; $\overline{MW}$: 5000)	10.0 %
silicone oil	0.05%
hydrophilic silicic acid	3.5 %

castor oil, to make up	100	%
viscosity: 5000 cp		

Example 7

Phosphamidon techn.	65.6	%
calcium dodecylbenzenesulfonate	1.6	%
polyglycerol phthalate	1.6	%
oleyl alcohol polyglycol		
ether (10 EO)	3.0	%
silicone oil	0.08	%
hydroxypropyl cellulose	0.82	%
dipropylene glycol monomethyl		
ester, to make up	100	%
viscosity: 3000 cp		

Example 8

Monocrotophos techn.	60.6	%
hydroxypropyl cellulose	4.0	%
dipropylene glycol methyl		
ether, to make up	100	%
viscosity: 3000 cp		

Example 9

Propargyl 2-[4-(5-chloro-5-fluoro-		
pyrid-2-yloxy)phenoxy]propionate	24.0	%
5-chloro-8-(1-methylhexyloxycarbonyl-		
methoxy)quinoline	6.0	%
N-methylpyrrolidone	5.0	%
calcium dodecylbenzoate	7.0	%
nonylphenol polypropylene(13)poly-		
ethylene(20)glycol	13.0	%
hydrophilic silicic acid	2.1	%
ethyl cellulose	2.1	%
anisole, to make up	100	%
viscosity: 2000 cp		

Example 10: A web of polyvinyl alcohol (manufacturer: Syntana Handelsgesellschaft GmbH, Mülheim-Ruhr, FRG), 200 mm wide and 35 μ m thick, is fed continuously to a filling machine (manufacturer: NEDI S.A., Saint-Mammes, France) in which it is welded by pulse welding with a longitudinal seam to form a tube which is sealed at its end by a transverse welding seam. After each being filled with 100 g of active ingredient concentrate according to Example 3, the so preformed bags are then separated by a severing welding seam to give sealed bags 135 mm in length which contain the active ingredient concentrate.

The packages so obtained dissolve in 25-200 l of water of 15-20°C in approx. 1 minute to give a ready-for-use spray mixture.



Patent Claims

1. A pesticide concentrate in packaged form comprising a water-soluble package and a liquid, non-aqueous pesticide concentrate, wherein the concentrate comprises one or more water-insoluble active ingredients, a solvent that is inert towards the water-soluble packaging material, a viscosity-increasing additive and one or more dispersants, and wherein the viscosity of the liquid pesticide concentrate is 1000-20 000 cp.
2. A pesticide concentrate according to claim 1, which comprises as active ingredient(s) one or more insecticides, acaricides, fungicides, herbicides or plant-growth-regulating substances.
3. A pesticide concentrate according to claim 1, which comprises as solvent an alcohol, alkanediol (glycol), diethylene glycol monoether, ketone, ester, aliphatic or aromatic hydrocarbon or mineral or vegetable oil.
4. A pesticide concentrate according to claim 3, which comprises as solvent cyclohexanol, diacetone alcohol, cyclohexanone, butyrolactone, amyl acetate, toluene, xylene or a mixture of alkylbenzenes having a boiling range of 130-170°C.
5. A pesticide concentrate according to claim 1, which comprises a water-soluble polymer or hydrophilic silicic acid as viscosity-increasing additive.
6. A pesticide concentrate according to claim 5, which comprises as viscosity-increasing additive a cellulose derivative, a protein (gelatin) or polyvinylpyrrolidone having a molecular weight of 600 000-1000 000.



7. A pesticide concentrate according to claim 6, which comprises as viscosity-increasing additive methyl cellulose, ethyl cellulose, hydroxyethyl cellulose or hydroxypropyl cellulose.

8. A pesticide concentrate according to claim 1, wherein the packaging material consists of a film made from a water-soluble polymer.

9. A pesticide concentrate according to claim 8, wherein the water-soluble packaging material is a film made from polyvinyl alcohol, polyvinylpyrrolidone, a copolymer of vinyl alcohol and vinylpyrrolidone, a copolymer of vinyl alcohol and vinyl acetate, or is a cellulosic film.

10. A pesticide concentrate according to claim 8, wherein the packaging material is a film made from polyvinyl alcohol.