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ABSTRACT

A particulate water dispersible adjuvant composition for a pesticide comprising a plant nutrient, an oil and a surfactant.

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**COMPLETE SPECIFICATION
(ORIGINAL)**

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Invention Title:

ADJUVANT COMPOSITION FOR USE WITH A PESTICIDE AND A PROCESS FOR
PREPARATION THEREOF

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The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

- 1 -

**ADJUVANT COMPOSITION FOR USE WITH A PESTICIDE AND A
PROCESS FOR PREPARATION THEREOF**

Field

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The present invention relates to a water dispersible adjuvant formulation comprising a plant nutrient for use with a pesticide and to a process for preparation of the adjuvant. The invention further provides a method of applying herbicide, particularly a knock-down herbicide, using the adjuvant.

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The use of a fertiliser such as ammonium sulfate is known to improve the efficacy of certain herbicides. Knock-down herbicides, such as glyphosate are often applied in the field with plant nutrients such as ammonium sulfate.

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The performance of some knock-down herbicides such as glyphosate, has been shown to be reduced with poor quality water. In particular the presence of hard water having high levels of dissolved salts or cold water can significantly reduce the efficacy of glyphosate composition. Soluble plant nutrients such as ammonium sulphate have been shown to enhance the performance of glyphosate under these conditions. John Nalewaja of North Dakota University has studied the effect of various plant nutrients on glyphosate activity. Papers by Nalewaja et al include Weed Tech. 9:587-593; Weed Tech. 7:337-342, Weed Sci 40:576-589 and Weed Sci 39: 622-628. The performance of some herbicides is also reduced when they are applied in hot conditions due to evaporation and spray drift.

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Solubility problems caused by hard water may cause blockages in spray lines or in the fine nozzles frequently used in spraying. The problems of solubility have been exacerbated by packaging of nutrients such as ammonium sulfate with certain non-ionic surfactants. These problems are address for example in US Patent 5,356,861 (Gednalske et al) which describes a blend of the herbicide glyphosate and an adjuvant including ammonium sulfate and a certain alcohol polysaccharide surfactant. Gednalske et al attempts to provide ammonium sulfate compositions in hard water and to overcome the problems of using a

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non-ionic surfactant by blending a herbicide with water, ammonium sulfate and alkyl polysaccharide in certain proportions. Non-ionic surfactants are often only poorly soluble in salt solutions and compositions of salt solutions often have poor stability.

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Australian Patent Application No. 200042760 in the name of Victorian Chemicals International Pty Ltd discloses a composition which contains one or more oils soluble bases to enable a homogeneous blend to be formed of actives which include organic acids, plant nutrients such as ammonium salts, water and lipophilic solvents. Aqueous compositions of this type containing ammonium sulphate while improving performance are not effective in water of moderate to very hard water conditions.

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The discussion of documents, acts, materials, devices, articles and the like is included in this specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of these matters formed part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed in Australia before the priority date of each claim of this application.

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There is a need for an adjuvant composition which will allow herbicides to be highly effective in a range of water conditions.

Summary

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The present invention provides a water dispersible particulate adjuvant composition comprising a plant nutrient, an oil and a surfactant.

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Preferably the composition comprises particulate plant nutrient (and optionally other solid materials) onto which has been absorbed an oil and surfactant composition.

In a further embodiment the invention provides a process for preparing an adjuvant for a pesticide the process comprising mixing a particulate material comprising a plant nutrient with a surfactant and an oil.

- 5 In a further embodiment the invention provides a method of controlling weeds comprising forming an aqueous mixture of the hereinabove described particulate adjuvant with a herbicide and applying the mixture to the weed to be controlled. The herbicide may be a pre-emergent or post-emergent herbicide.
- 10 We have found that by using a granular or powdered composition in accordance with the present invention together with the oil and a surfactant composition a high level of plant nutrient can be used in the composition and the composition achieves excellent performance even when hard water is used.
- 15 Throughout the description and the claims of this specification the word "comprise" and variations of the word, such as "comprising" and "comprises" is not intended to exclude other additives, components, integers or steps.

Detailed Description

- 20 The composition of the present invention contains a plant nutrient such as ammonium sulfate in powdered or granular form. The powdered or granular plant nutrient may contain further components particularly inert fillers such as silica or talc. The ammonium sulfate particulate composition may further
- 25 include other additives which improve the flow and/or prevent caking of the composition. The particulate composition of the invention may be in the form of powder or in the form of granules or prills. The granular or prill composition may be formed using granulation techniques known in the art such as pan granulation or extrusion. The adjuvant of the invention may comprise many fine
- 30 particles such as in the form of a powder but is more preferably granular. Granules may be of any size but preferably the size is in the range of from 400 to 6000 microns, more preferably 500 to 5,000 microns and most preferably from 1,000 to 3,000 microns in diameter. The length of the granules is preferably from 1 to 5 times the diameter.

The particulate or powder component will typically comprise at least 20% by weight of the total composition of the invention and will preferably be at least 40% by weight of the total composition of the invention and most preferably the nutrient will be present in an amount of 50% by weight of the total composition. Typically no more than 90% by weight and preferably no more than 75% by weight of a plant nutrient such as ammonium sulfate will be used.

The composition of the invention comprises an oil which may be a vegetable or mineral oil. The oil is preferably selected from vegetable oil and vegetable oil derivatives. We have found that it is a particular advantage in accordance with the invention to use an oil which contains a significant proportion of esterified vegetable oil. The preferred esterified vegetable oils are methyl and ethyl ester vegetable oils. Esterified oils generally give better drift control and generally better efficacy. The fatty acid portion of the vegetable oil will typically have a carbon chain length in the range of from 8 to 22 carbon atoms and most preferably from 12 to 20 carbon atoms. Methyl and ethyl esterified canola oil and mixtures thereof are particularly suitable.

The oil component of the composition will preferably be used in an amount from 1 to 20% by weight of the total composition, preferably from 5 to 15% by weight of the total composition and most preferably from 9 to 15% by weight of the total composition.

The composition of the invention comprises a plant nutrient such as an ammonium salt, urea or other suitable fertiliser. The preferred plant nutrient component of the invention comprises one or more salts of ammonium. The preferred ammonium salts are formed with inorganic ions such as phosphate, sulphate and the like. The most preferred particulate plant nutrient is ammonium sulphate.

The composition of the invention contains a surfactant component which includes one or more surfactants. The surfactant component may be chosen in accordance with the desired properties for applying a specific herbicide. The

surfactant may contain a non-ionic, cationic, amphoteric or anionic surfactant. The preferred surfactants are aminethoxylates or alcohol alkoxylates. Examples of preferred surfactants include siloxane alkoxylates, alkyl polysaccharides, sorbates, polysorbates, alcoholalkoxylates, alkylphenyl
5 alkoxylates, glycols, fatty alkanolamides, alkyl diamine alkoxylates, glycol block copolymers, ethoxylated sorbitan esters, alkyl ethoxy sulfates and amine oxide surfactants.

10 Blends of surfactants may also be used for example a blend of ethoxylated sorbitan esters blended with ethoxylated triglyceride or a blend of alkylphenyl ethoxylate with esterified fatty acid may be used. The surfactant component of the adjuvant of the invention will generally be from about 1 to 20% by weight of the total composition and more preferably from 3 to 8% by weight of the total composition.

15 The composition of the invention may and typically will contain inert fillers such as silica, talc, clays, zeolites and other additives for providing buffering, flow or anti-caking properties. Generally the inert fillers will be present in an amount of up to 40% by weight of the total composition. Preferably the fillers will be
20 present in an amount from 5 to 35% and most preferably from 10 to 30% by weight of the total composition of the invention.

The composition of the invention is in dry form. That is, it is generally in the form of free flowing powder or granules. It will be understood by those skilled in
25 the art having regard to the above discussion that the compositions of the invention may contain a minor amount of moisture or water provided the components together provide a free flowing solid composition. Typically the composition of the invention will contain no more than 10% by weight of the total composition of water. More preferably water will be present in no more
30 than an amount of from 7% and most preferably no more than about 4% by weight of the total composition.

The composition of the present invention is particularly suited to being used as a tank mix adjuvant with herbicides. Generally the composition will not contain

any herbicidal components but will be used in preparing herbicidal tank mix by mixing the composition with water and herbicide at or near the place it is to be used. The compositions of the invention have the advantage that they do not require the transport of liquid solution. Further we have found that compositions of the invention provide more consistent performance in a variety of conditions including or poor quality water at the site of use. Dry formulations of the present invention also have the significant advantage that they are sold in paper packaging which avoids the problems of disposing or recycling of liquid containers generally required by prior art compositions. Generally the compositions of the invention will be mixed with water in an amount of from 100 to 3000 grams of adjuvant per 100 litres of water.

In one embodiment the composition of the invention is provided packaged in a bag which is designed to disintegrate in water. In this way the composition of the invention may be added together with the package to form a tank mix thereby avoiding the need for the operator to handle the adjuvant. This also avoids any possibility of powder or fines being inhaled by the operator.

In a further embodiment of the invention the composition comprises additional active components such as fungicide or particularly a knock-down herbicide such as glyphosate. Where used a herbicide is present in an amount of 10-90% by weight of the total composition.

The composition of the invention may be prepared by a range of methods. We have found that a particularly useful method is to combine the solid components including the ammonium sulfate and fillers such as talc and silica and to spray a premix of the surfactant and oil onto the dry components to absorb them onto the dry components.

In one variation of this process the surfactant and oil component may be mixed with from 2 to 5% of water by weight of the total composition and sprayed onto the composition. In this process the composition may be mixed to form an extrudible dough which can be extruded through a suitable die to form pills or granules.

In an alternative method the components are combined in a microdyne or hammer mill optionally with the addition of a small amount of water.

- 5 Additional amounts of water may be used in the preparation process if desired, however it is preferred to use low amounts of water to avoid the need to subsequently remove water to form a dry flowable product.

- 10 The invention will now be described with reference to the following examples. It is to be understood that the examples are provided by way of illustration of the invention and that they are in no way limiting to the scope of the invention.

Examples

Example 1

- 15 This example demonstrates a composition of the invention in the form of prills which may be used as an adjuvant for herbicides. A prill composition was formed using the following components in the amounts by weights specified:

- | | | |
|----|--|--------|
| | ammonium sulphate | 50% |
| 20 | esterified seed oil containing methyl and ethyl esters | 10% |
| | surfactant blend of ethoxylated sorbitan esters and ethoxylated caster oil | 2.5% |
| | talc | 14.75% |
| | silica | 14.75% |
| | non-ionic emulsifier (alcohol alkoxylate) | 5% |
| 25 | water | 3% |

- 30 To prepare the prill adjuvant a premix was formed of all solid components and a dough was formed by spraying a mixture of the water surfactant and oil components onto the solids. The dough was extruded through a suitable die to provide extrusions which were broken down to form prills.

Example 2

This example demonstrates a low cost granular adjuvant in accordance with the invention. The granular adjuvant was formed using the following components in the amounts by weights specified:

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- | | |
|---|-------|
| ammonium sulphate | 62% |
| talc | 10% |
| silica | 10% |
| esterified canola oil including methyl and ethyl esters | 12.5% |
| 10 amine ethoxylates surfactant | 5.5% |

The amine ethoxylate surfactant contained from 15 to 20 ethylene oxide units condensed with tallow amine or soy amine.

- 15 The granules were formed by spraying a mixture of the oil and surfactant onto the solid components in a ribbon blender. This provides an inexpensive method of forming granules without the requirement to use water.

Example 3

- 20 This example demonstrates the use of the adjuvant composition of example 1 or 2 in the preparation of a herbicidal composition.

- A herbicidal composition of glyphosate was prepared in a spray tank. The spray tank was filled to half the required level with water to which was added
25 the adjuvant in an amount of from 500 to 1500 grams per 100 litres. A commercial glyphosate formulation was then added to in amount to provide a final concentration in the range of from 100 to 1000 grams based on glyphosate acid per 100 litres of formulation.

- 30 The tank was then topped up with water the required level and the tank mix used to apply the herbicide/adjuvant mixture to weeds.

Example 4

Ryegrass control with Roundup CT 450 + Adjuvant in 3 WHO water (1024 ppm CaCO₃)

- 5 This example compares the control of ryegrass using a composition of the invention and corresponding compositions of surfactant, vegetable oil derivative and "Ammend" adjuvant.

	%Control of Ryegrass 140g ai/ha Glyphosate
10 No adjuvant	38.2
200 mL/100L SPREADWET 1000	60.4
500 MI/100L ACTIVOIL	67.2
15 2L/100l Ammend	76.5
700g/100L Example 2	84.0

- 20 The compositions of the invention shows improved control with glyphosate when compared with a conventional adjuvant recommendation and each of the components.

Example 5

- 25 This example compares the control of barley using SELECT Clethodim herbicide and the adjuvant of Example 2 with corresponding compositions of SELECT with other adjuvants.

SELECT on Barley cv Grimmet – SELECT at 100 ml/Ha

	% Control
ADJUVANT	
30 Untreated	0
NIL Adjuvant	66
500 mL/100L ACTIVOIL	85
700 G/100L Example 2	90

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The Composition of the invention showed improved control with SELECT
(Clethodim selective herbicide).

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The claims defining the invention are as follows:

- 5 1. A particulate water dispersible adjuvant composition for a pesticide comprising a plant nutrient, an oil and a surfactant.
2. A particulate adjuvant according to claim 1 comprising the plant nutrient (and optionally other solid materials) in particulate form onto which has been absorbed an oil and surfactant composition.
- 10 3. A particulate adjuvant according to any one of the previous claims wherein the adjuvant is a granular composition formed by applying oil and a surfactant to a granular plant nutrient.
4. A particulate adjuvant according to any one of the previous claims
15 wherein the particles are of size in the range of from 400 to 6,000 microns.
5. A particulate adjuvant according to any one of the previous claims wherein the particles are of size in the range of from 1,000 to 3,000 microns in diameter.
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6. A particulate adjuvant according to claim 4 or claim 5 wherein the length of the granules is from 1 to 5 times the diameter.
7. A particulate adjuvant composition according to any one of the previous
25 claims wherein the plant nutrient constitutes at least 20% by weight of the total adjuvant composition.
8. A particulate adjuvant according to claim 7 wherein the plant nutrient constitutes at least 40% by weight of the total adjuvant composition.
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9. A particulate composition according to any one of the previous claims wherein the plant nutrient constitutes in the range of from 50% by weight of the total adjuvant composition up to 90% by weight of the total adjuvant composition.

10. A particulate composition according to claim wherein the plant nutrient constitutes no more than 90% by weight of the total adjuvant composition.
- 5 11. A particulate composition according to any one of the previous claims wherein the oil component is selected from the group consisting of mineral oils, vegetable oils, vegetable oil derivatives and mixtures of two or more thereof.
- 10 12. A particulate composition according to claim 11 wherein the oil is selected from at least one of vegetable oils and esterified vegetable oils.
13. A particulate composition according to any one of the previous claims wherein the oil comprises and esterified vegetable oil.
- 15 14. A particulate composition according to any one of the previous claims wherein the oil comprises at least one of methyl and ethyl ester vegetable oils.
- 20 15. A particulate according to any one of the previous claims wherein the oil comprises an esterified vegetable oil wherein the acid derived portion thereof comprises a carbon chain length in the range of from 8 to 22.
- 25 16. A particulate composition according to any one of the previous claims wherein the oil comprises at least one oil selected from methyl and ethyl esterified canola oil.
17. A particulate composition according to any one of the previous claims wherein the oil component is present in an amount from 1 to 20% by weight of the total adjuvant composition.
- 30 18. A particulate composition according to any one of the previous claims wherein the oil component is present in an amount of from 5 to 15% by weight of the total adjuvant.

19. A particulate composition according to any one of the previous claims wherein the plant nutrient component comprises at least one compound selected from the group consisting of ammonium salts and urea.
- 5 20. A particulate composition according to any one of the previous claims wherein the plant nutrient comprises ammonium salts formed with one or more inorganic ions.
- 10 21. A particulate composition according to any one of the previous claims wherein the plant nutrient is ammonium sulphate.
- 15 22. A particulate composition according to any one of the previous claims wherein the surfactant comprises at least one surfactant selected from the group consisting of aminethoxylates or alcohol alkoxyates siloxane alkoxyates, alkyl polysaccharides, sorbates, polysorbates, alcoholalkoxyates, alkylphenyl alkoxyates, glycols, fatty alkanolamides, alkyl diamine alkoxyates, glycol block copolymers, ethoxylated sorbitan esters, alkyl ethoxy sulfates and amine oxide surfactants.
- 20 23. A particulate composition according to any one of the previous claims wherein the surfactant is a blend of at least one ethoxylated sorbitan ester with at least one ethoxylated triglyceride or a blend of at least one alkylphenyl ethoxylate with at least one esterified fatty acid.
- 25 24. A particulate composition according to any one of the previous claims wherein the surfactant component of the adjuvant constitutes in the range of from 1 to 20% by weight of the total adjuvant composition.
- 30 25. A particulate composition according to any one of the previous claims wherein the composition further comprises one or more inert fillers in an amount from 5 to 35% by weight of the total adjuvant composition.

26. A particulate composition according to any one of the previous claims containing no more than 10% by weight of the total adjuvant composition of water.
- 5 27. An aqueous tank mix comprising the adjuvant of any one of the previous claims with at least one herbicide and diluted with water.
28. An aqueous tank mix according to claim 27 wherein the herbicide comprises glyphosate.
- 10 29. A particulate composition according to any one of claims 1 to 26 packaged in a bag which is designed to disintegrate in water.
30. A herbicidal composition comprising a particulate adjuvant according to
15 any one of claims 1 to 26 and at least one herbicide in an amount of from 10-90% by weight of the total herbicidal composition.
31. A process for preparing a particulate adjuvant for a pesticide the process comprising mixing a particulate material comprising a plant nutrient with a
20 surfactant and an oil.
32. A process according to claim 31 wherein the surfactant component and oil components are sprayed onto the particulate plant nutrient and optionally fillers of the adjuvant composition to absorb them into the plant nutrient.
- 25 33. A process according to claim 33 wherein the surfactant and oil component are mixed with from 2 to 5% of water by weight of the total composition and sprayed onto the plant nutrient and optionally fillers.
- 30 34. A process according to claim 33 wherein the composition is extruded to form granules.

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