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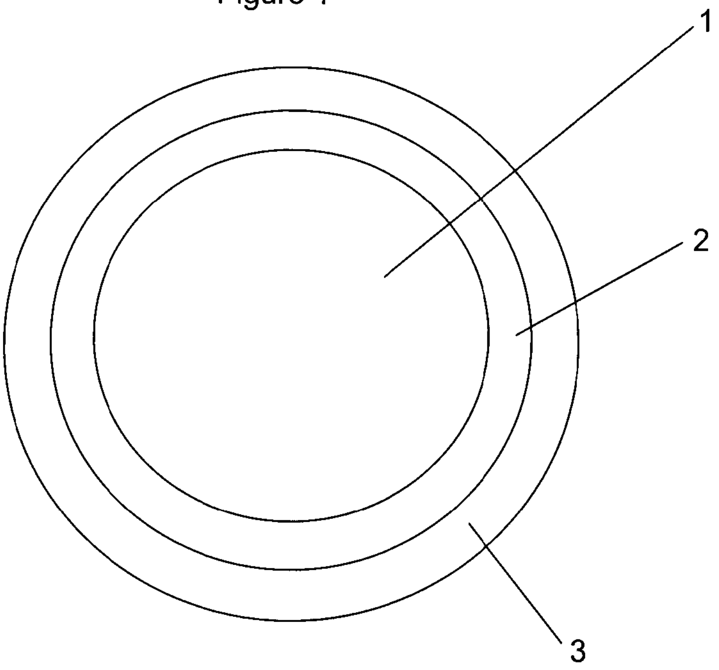
(54) Title: IMPROVEMENTS IN AND RELATING TO FERTILISER COMPOSITIONS

Figure 1



(57) Abstract: A fertiliser composition which includes a core comprising a fertliser granule/chip, or mineral granule/chip, wherein the core is coated with a first layer comprising a mixture of a plant based oil and a wax or resin, the first layer is then itself coated with at least one further layer comprising a powdered trace element or mixture of powdered trace elements.

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IMPROVEMENTS IN AND RELATING TO FERTILISER COMPOSITIONS

TECHNICAL FIELD

The present invention relates to improvements in and relating to fertiliser compositions. In particular the present invention relates to coated fertiliser compositions.

BACKGROUND ART

The use of fertiliser compositions in agriculture is well known.

For illustrative purposes the present invention will now be discussed in relation to one major type of fertiliser in use in agriculture today namely urea. However, it should be understood that the principles of the present invention can be applied to other types of fertiliser and hence any discussion in relation to urea should not be seen as limiting.

Urea is a popular fertiliser due to its high nitrogen content which can be easily broken down into plant assimilable ammonia and nitrate by soil bacteria.

However, the solubility and availability of urea means that it is susceptible to nitrogen leaching shortly after being applied to a pasture which is non-ideal. It would therefore be useful if there could be provided a way in which the nitrogen content of urea could be released in a controlled manner over a sustained period of time following application.

Moreover, it would be useful if urea could be formulated to additionally provide additional nutrients and/or trace elements to a pasture.

It would also be useful if urea could be formulated to be capable of being blended with freshly acidulated phosphate fertilisers so as to avoid double salt formation.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

Throughout this specification, the word "comprise", or variations thereof such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DEFINITIONS

The term 'fertiliser' as used herein refers to any substance added to soil, land or other plant growth medium in order to increase fertility.

The terms 'granule' and 'chip' as used herein are used interchangeably and refer to a small compact particle of substance. The particle will generally be of a size in the order of substantially between 1mm -10mm and most preferably between 2mm-5mm. The granule/chip may be naturally occurring or may be fashioned by human manipulation.

The term 'mineral' as used herein refers to a solid naturally occurring substance which is beneficial to a plant or animal life. Some non-limiting exemplary examples will be detailed subsequently herein.

The term 'wax' as used herein refers to a synthetic or naturally occurring compound which is generally malleable at fairly wide band of room temperatures (i.e. around 5°C - 45°C) and liquid above 45°C and insoluble in water but soluble in organic non-polar solvents. Some non-limiting exemplary examples will be detailed subsequently herein.

The term 'resin' as used herein refers to any component of a liquid which can harden (solidify) into a lacquer or enamel like finish. Some non-limiting exemplary examples will be detailed subsequently herein.

The term 'plant based oil' as used herein refers to:

a) a lipid material produced by a plant which is liquid at room temperatures of around 5°C - 45°C and is viscous compared to water;

b) a lipid material which is chemically similar to, or is derived from, a lipid material produced by a plant which is liquid at room temperatures of around 5°C - 45°C and is viscous compared to water;

c) a lipid based material in a) or b) above which includes one or more additives yet remains liquid at room temperatures of around 5°C - 45°C and is viscous compared to water. One example of such a lipid based material is PEARL^{TM} oil which for the purposes of this specification is considered to be a plant based oil notwithstanding any small wax content therein. This is to be contrasted to PEARL US^{TM} oil which contains a much higher wax content and thus is not considered a plant based oil but is instead considered a mixture of a plant based oil and a wax.

The term ‘derived’ as used herein refers to something which is formed or developed from something else.

The term ‘trace elements’ as used herein refers to a chemical element found in small quantities in plants and/or the earth and which is used by organisms, including plants and animals, and is essential or beneficial, to their physiology. Some non-limiting exemplary examples will be detailed subsequently herein.

The term ‘assimilable’ as used herein refers to a substance which is able to be absorbed by a plant or animal.

DISCLOSURE OF THE INVENTION

Plant Based Oil and Wax / Trace Elements Bi-layered Coating

According to a first aspect there is provided a fertiliser composition which includes a core comprising a fertliser granule/chip, or mineral granule/chip, is the core being coated with a first layer comprising a mixture of a plant based oil and a wax or resin, the first layer is then itself coated with at least one further layer comprising a powdered trace element or mixture of powdered trace elements. – Covers Examples 1-3, 4,5-10

PEARL™ Oil and Wax / Trace Elements Bi-layered Coating

According to a second aspect there is provided a fertiliser composition which includes a core comprising a fertliser or mineral granule/chip which is coated with a first layer comprising a mixture of a plant based oil in the form of PEARL™ oil and wax, the first layer is itself coated with at least one further layer comprising a powdered trace element or mixture of powdered trace elements. – Covers Examples 1-3.

Linseed Oil and Wax / Trace Elements Bi-layered Coating

According to a third aspect there is provided a fertiliser composition which includes a core comprising a fertliser or mineral granule/chip which is coated with a first layer comprising a mixture of a plant based oil in the form of boiled linseed oil and wax , the first layer is itself coated with at least one further layer comprising a powdered trace element or mixture of powdered trace elements.

Plant Based Oil and Wax / Trace Elements with a Plurality of Coating Layers

According to a fourth aspect there is provided a fertiliser composition which includes a core comprising a fertilizer or mineral granule/chip wherein the core is coated with:

- a layer comprising a mixture of a plant based oil and wax/resin;
- a powdered trace element or a mixture of powdered trace elements; and
- one or more further alternating layers of:
    a) an acrylic emulsion and plant based oil; and
    b) a powdered trace element, or a mixture of powdered trace elements.

Setting Agent

According to a fifth aspect there is provided a use of maleic acid as a setting agent in the manufacture of a multiple coated fertiliser composition using substantially non-aqueous liquid coating materials.

Linseed can set hard but need to always use maleic acid to help it set (i.e. shortens the time period for the oil to set).

Method of Manufacturing an Extended Release Coating

According to a sixth aspect there is provided a method of manufacturing an extended release coating for fertiliser composition which includes a core comprising the steps of:

a) adding wax/resin to a plant based oil;

b) heating the mixture from step a); and

c) stirring the mixture until substantially homogenous.

Extended Release Coating

According to a seventh aspect there is provided an extended release coating for a core of a fertiliser composition which includes:

a) a mixture of a wax, or resin, and plant based oil, which is substantially homogenous.

A Method of Manufacturing an Extended Release Fertiliser Composition which is Bi-layered

According to an eigth aspect there is provided a method of manufacturing an extended release fertiliser composition which includes a core including a fertiliser or mineral granule comprising the steps of:

a) adding a homogenous mixture of:

  - a plant based oil; and
  - a wax or resin;

to a quantity of fertiliser granules or chips;

b) mixing the resulting mixture;

c) adding powdered trace element(s) to the mixture; and

d) mixing the resulting mixture until the coated granules are free flowing.

A Method of Manufacturing an Extended Release Fertiliser Composition which has a Plurality of Layers

According to a ninth aspect there is provided a method substantially as described above wherein the method comprises the additional steps of:

e) adding:

- an acrylic emulsion; or
- a homogenous mixture of a plant based oil and wax or resin;

to fertiliser granules or chips from step d) above, or step h) below, as appropriate;

f) mixing the resulting mixture;

g) adding powdered trace element(s) to the mixture;

h) mixing the resulting mixture until the coated granules are free flowing; and

i) repeating steps e)-h) until described number of layers has been achieved.

A Fertiliser Blend Including an Extended Release Fertiliser Composition

According to a tenth aspect there is provided a fertiliser blend which includes a quantity of standard urea and a quantity of an extended release composition substantially as described above..

The inventor has found that changing the type of, or relative amount of, wax/resin used in the mixture can alter the viscosity of the mixture.

Without wishing to be bound by theory it is believed that the wax/resin increases the tackiness of the oil which helps the oil/wax mixture, or oil/resin mixture, adhere to the granule as well as bind the powdered trace elements thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

Further aspects of the present invention will become apparent from the ensuing description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1	shows a cross sectional schematic view of a fertiliser composition in accordance with one preferred embodiment of the present invention;
Figure 2	shows a release profile (in minutes) of various coated fertiliser compositions;
Figure 3	shows the release profile (in hours) of one preferred embodiment of coated fertiliser composition which is detailed in Figure 2; and
Figure 4	shows a cross sectional schematic view of a fertiliser composition in accordance with another preferred embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

PEARL OIL/WAX coatings

Examples 1- 3 below were all made using one of the following oil/wax mixtures.

WOPearl

20g PEARL™ oil is added to 10g of Galoryl ATH 709 wax and is mixed and stirred until homogenous at 55°C. The resulting oil/wax mixture solidifies at ambient temperatures (i.e. 10 – 30 °C).

5% Oil/Wax Mixture

1g of Galoryl ATH 709 wax is added to 19g of PEARL™ oil and is mixed and warmed to approx 40 – 50°C. The resulting oil/wax mixture is fluid at ambient temperatures (i.e. 10 – 30°C).

10% Oil/Wax Mixture

2g of Galoryl ATH 709 wax is added to 18g of PEARL™ oil and is mixed and warmed to approx 40 – 50°C. The resulting oil/wax mixture is viscous at ambient temperatures (i.e. 10 – 30°C).

Example 1 (Mixture A)

Apply 0.75g warm 10% oil/wax to 96.75g urea. Then add 2.5g MgO (Korean) and mix well until granules free flow.

Example 2 (Mixture B)

Apply 0.75g warm 10% oil/wax mix to 96.75g urea. Then add 2.5g MgO (EMag) and mix well until granules free flow.

Example 3 (Mixture C)

Apply 0.75g warm WOPearl oil/wax mix to 96.75g urea. Then add 2.5g MgO (Korean) and mix well until granules free flow.

Boiled Linseed Oil/Wax/Maleic Acid Coatings

Example 4 below was made using one of the following oil/wax mixture.

Oil Mix WO3/2

> 20g boiled linseed oil is heated to about 60-70°C. Then 10g Galoryl ATH 709 wax is added and the mixture stirred until homogenous. Then 100mg maleic acid is added and the resulting oil/wax/maleic acid mixture is stirred well.

Example 4 (EXP β/4)

Add 6.9g warm WO3/2 to 100g urea and mix well. Place in drum and add 9.6g MgO and rotate for 2-3 minutes. The coated urea granules should be free flow and have a pale cream even coating thereon.

Figure 1 shows a urea core (1) which is coated with a WO3/2 layer (2) and a further outer layer of MgO (3).

PEARL Oil/Resin Coatings

Examples 5 -10 below were made using the following oil/resin mixtures.

Mixtures of Pearl Oil + C9 Petroleum Resin (PR)

RP1 5% Oil/Resin

Add 1g resin (supplied by Connell Bros Company Australasia) to 19g Pearl oil, stir and heat the mixture until homogeneous.

N.B. In practice it was found necessary to heat up to ca. 110°C.

RP2 10% Oil/Resin

Add 2g resin to 18 g Pearl oil, stir and heat the mixture until homogeneous

RP3 20% Oil/Resin

Add 4g resin to 16 g Pearl oil, stir and heat the mixture until homogeneous

RP3 50% Oil/Resin

Add 10g resin to 10 g Pearl oil, stir and heat the mixture until homogeneous

All the above mixtures were fluid at ambient (20°C), except RP4 which formed a gel

Example 5 (UR1)

Mix 0.75g RP1 with 96.75g urea; then add 2.5g MgO(Korean) and remix

Example 6 (UR2)

Mix 0.75g RP3 with 96.75g urea; then add 2.5g MgO(Korean) and remix

Murray to check

Example 7 (UR4)

Mix 0.75g RP3 with 98.5g urea; then add 0.75g MgO(Korean) and remix.

Example 8 (UR5)

Mix 0.75g RP3 with 99.25g urea. No further additive.

Example 9 (UR6)

Mix 0.75g RP3 with 98.75g urea; then add 0.5g Sipernat ™ SiO2.

Example 10 – Extended Release Fertiliser Composition with a Plurality of Layers Surrounding Core.

Add 1.5g Galoryl ATH 709 wax to 1.5g PEARL™ oil and heat to 40-50°C. Then add the wax/oil mixture to 993 g of urea granules in a rotary drum and mix to coat the granules. Once the granules are coated add 2.5g MgO and free flow. Then add 0.5g of PRIMAL™ – E-1764K Acrylic Emulsion Polymer from ROHM HAAS before adding 1g of SiO_2 as a coating and rotating until the granules are free flow.

Figure 4 shows a urea core (1) which is coated with PEARL™ oil and wax (2) as per Example 10 and which has MgO layer (3). The MgO layer (3) is then coated with a layer (4) of PRIMAL™ – E-1764K Acrylic Emulsion Polymer as per Example 11 to which a final layer (5) of SiO_2 is adhered.

Example 11 – Blend including Multi-layered Extended Release Fertiliser Composition

50g of coated area prepared as per Example 10 above is added to 50g of freshly acidulated Superphosphate.

Example 12 - 10% Oil/Wax Mixture

Step 1.

20g of PEARL US™ oil is warmed to approx 40°C. The PEARL US™ oil is viscous at ambient temperatures (i.e. 10 – 30°C).

Step 2.

Apply 0.75g warm PEARL US™ 96.75g urea. Then add 2.5g MgO (Korean) and mix well until granules free flow.

Dissolution Testing – Materials and Methods

In relation to Figure 2 the release profiles compared were:

- standard (i.e. non-coated) urea;
- ß/4 was made as per Example 4 above;
- EXP ß/3/A Boiled Linseed Oil (BLO) only as coating made by:
    1. Adding 2.5g warm BLO to 45g urea and mixing well;
    2. Placing in drum and adding 5g MgO and rotating for 2-3 min.
    3. Remove from drum once coated urea granules have a pale cream even stable coating.

  The resulting coated granules have a total MgO of 9.5% and a total Oil Mix of 4.8%.

- Flexi-N was made by:
    1. Adding 2.5g warm Pearl™ oil to 45g urea and mixing well;
    2. Placing in drum and adding 5g MgO and rotating for 2-3 min.
    3. Remove from drum once coated urea granules have a pale cream even stable coating.

  Dissolution Method employed to yield the results in Figure 2 was as follows:

1. Place 150 ml water(20°C) into a 250ml beaker
2. Place 1.000 g material in the beaker
3. Note the time at this point
4. Leave the beaker and contents undisturbed
5. Place an overhead stirrer(calibrated to 5-10rpm) with broad paddle into the solution with paddle head just covered by the solution
6. At the time a subsample is required activate stirrer for 4-5 secs
7. Transfer a 1ml sample from the solution to a 100ml vol. flask. Dilute to 100
8. Analyse diluted sample for TKN

Results

Figure 2 clearly shows that all coated urea dissolved at a slower rate than standard urea (i.e. uncoated). In particular ß/4 had the most pronounced extended release characteristic of all the coated formulations tested.

Figure 3 shows – the release profile of standard urea to coated urea ß/4 over a 24 hour period. As can be seen ß/4 coated urea extends the release of urea to up around 5 hours compared to a couple of minutes for uncoated urea.

ALTERNATE WAYS TO IMPLEMENT THE INVENTION

The wax may be any wax.

The wax may be a petroleum wax.

In one preferred embodiment the wax may be paraffin wax.

In another preferred embodiment the wax may be palm wax.

In a further preferred embodiment the wax may be Galoryl ATH 709 as supplied by Lake Industries, Australia.

The resin may be any resin.

In another preferred embodiment the resin may be resin110C which has a melting point of 110°C.

In one preferred embodiment the resin may be C9 petroleum resin as supplied by Connell Bros Company Australasia Ltd.

In another preferred embodiment the resin may be a plant resin.

The inventors have found depending on the type of wax added to the plant based oil the resulting mixture may need to be heated to around 40 -50°C so as to be liquid when being added to the granule/chip. As the addition of wax to the plant based oil can cause the resulting mixture to become solid at room temperature. One such wax with these properties is paraffin wax.

The plant based oil may be any plant oil provided it doesn't react with urea or other acidulated fertilisers.

In one preferred embodiment the oil may be a vegetable based oil.

In some preferred embodiments the oil may be a naturally occurring oil.

In one preferred embodiment the oil may be boiled linseed oil.

In some preferred embodiments the oil may be a plant based oil.

In further preferred embodiments the plant based oil may include one or more further additives.

In one preferred embodiment the plant based oil composition may be PEARL^{TM} oil which is manufactured and supplied by Lake International Technologies (Pty) Limited. The information sheet states PEARL^{TM} oil is vegetable oil based polymer which is 100% biodegradeable and is manufactured from a highly oxidised vegetable oil which is reacted with a blend of various other, non-oxidised vegetable oils, surfactants and natural waxes, to form a stable polymer that sets after application. PEARL^{TM} oil product properties include:

• Appearance	Creamy Brown Liquid
• Density (25^{o}C)	0.85 – 1.0 kg/L
• Viscosity (25^{o}C)	50-300 mNs/m
• Particle size	<500 µm
• Flammability	Combustible at high temperatures
• Application temperature	Room temperature
• Non toxic	
• Non hazardous	

The trace elements may be any trace elements it is desired to deliver to a plant. In some cases the trace elements may benefit the plant (e.g. for increased growth or other desired physiological response) and in other cases the trace elements may be for delivery to an animal via the animal's ingestion of a plant.

Some non-limiting exemplary examples of suitable powdered trace elements for the coating include plant and/or animal assimilable forms of:

- Magnesium
- Silicon
- Copper
- Boron
- Selenium
- Zinc
- Iron
- Manganese
- Iodine
- Calcium

However this list is not exhaustive. The purpose of the trace elements is to enhance the value of the plant to an animal. For example, the inclusion of selenium in a plant increases the levels of selenium within an animal which ingests said plant.

In one preferred embodiment the powdered trace element may be in the form of magnesium oxide.

In another preferred embodiment the powdered trace element may be in the form of silicon dioxide.

The minerals may be any minerals it is desired to deliver to a plant. In some cases whilst the minerals may primarily benefit the plant (e.g. for increased growth or other desired physiological response) the minerals may also be beneficial to an animal upon delivery thereto via the animal's ingestion of a plant.

Some non-limiting exemplary examples of suitable minerals for the core include plant assimilable forms of:

- Phosphorous
- Nitrogen
- Potassium

However this list is again not exhaustive. The purpose of the minerals is generally to improve the physiology of a plant, or in some cases plant and/or animal which assimilates the mineral.

In some preferred embodiments the minerals may be selected from one or more of the following assimilable forms:

- Single super phosphate
- Diammonium phosphate
- Monoammonium phosphate
- Ammonium Polyphosphate
- Ammonium sulphate
- Potassium chloride
- Potassium Sulphate

- Potash e.g. potassium carbonate or potassium hydrochloride

Again this list is not intended to be exhaustive.

The acrylic emulsion used when creating a plurality of layers around the granule/chip may be any suitable stable emulsion having regard to the composition and its intended use.

In preferred embodiments the acrylic emulsion may be PRIMAL™ – E-1764K Acrylic Emulsion Polymer from ROHM HAAS.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof as defined in the appended claims.

WHAT WE CLAIM IS:

1. A fertiliser composition which includes a core comprising a fertliser granule/chip, or mineral granule/chip, wherein the core is coated with a first layer comprising a mixture of a plant based oil and a wax or resin, the first layer is then itself coated with at least one further layer comprising a powdered trace element or mixture of powdered trace elements.

2. A fertiliser composition as claimed in claim 1 wherein the plant based oil is in the form of a vegetable oil based polymer which is 100% biodegradable and is manufactured from a highly oxidized vegetable oil.

3. A fertiliser composition as claimed in claim 1 wherein the plant based oil is in the form of boiled linseed oil.

5. A fertiliser composition as claimed in any one of claims 1-3, which includes a quantity of standard urea and a quantity of an extended release composition substantially as described above.

6. A fertiliser composition which includes a core comprising a fertilizer or mineral granule/chip wherein the core is coated with:

    - at least one further layer comprising a mixture of a plant based oil and wax/resin; and

    - a first powdered trace element, or a mixture of powdered trace elements; and

    - one or more further alternating layers of:

        a) an acrylic emulsion or a plant based oil; and

b) a second powdered trace element, or a mixture of powdered trace elements.

7. A fertiliser composition as claimed in claim 6 wherein the core is a urea granule.

8. A fertiliser composition as claimed in claim 7 wherein the first powdered trace element is MgO.

9. A fertiliser composition as claimed in claim 8 wherein the second powdered trace element is SiO_2.

10. A method of manufacturing an extended release fertiliser composition which includes a core including a fertiliser or mineral granule comprising the steps of:

a) adding a homogenous mixture of:

- a plant based oil; and
- a wax or resin;

to a quantity of fertiliser granules or chips;

b) mixing the resulting mixture;

c) adding powdered trace element(s) to the mixture; and

d) mixing the resulting mixture until the coated granules are free flowing.

5. A fertiliser composition which includes a blend of urea and superphosphate wherein either the urea or the superphosphate forms a core which is coated with:

- at least one further layer comprising a mixture of a plant based oil and wax/resin; and
- a first powdered trace element, or a mixture of powdered trace elements; and
- one or more further alternating layers of:
  - a) an acrylic emulsion or a plant based oil; and
  - b) a second powdered trace element, or a mixture of powdered trace elements.

11. A method of manufacturing an extended release fertiliser composition which includes a core including a fertiliser or mineral granule comprising the steps of:

a) adding a homogenous mixture of:

- a plant based oil; and
- a wax or resin;

to a quantity of fertiliser granules or chips;

b) mixing the resulting mixture;

c) adding powdered trace element(s) to the mixture; and

d) mixing the resulting mixture until the coated granules are free flowing.

e) adding:

- an acrylic emulsion; or

- a homogenous mixture of a plant based oil and a wax or resin;

to fertiliser granules or chips from step d) above, or step h) below, as appropriate;

f) mixing the resulting mixture;

g) adding powdered trace element(s) to the mixture;

h) mixing the resulting mixture until the coated granules are free flowing; and

i) repeating steps e)-h) until desired number of layers has been achieved.

Figure 1

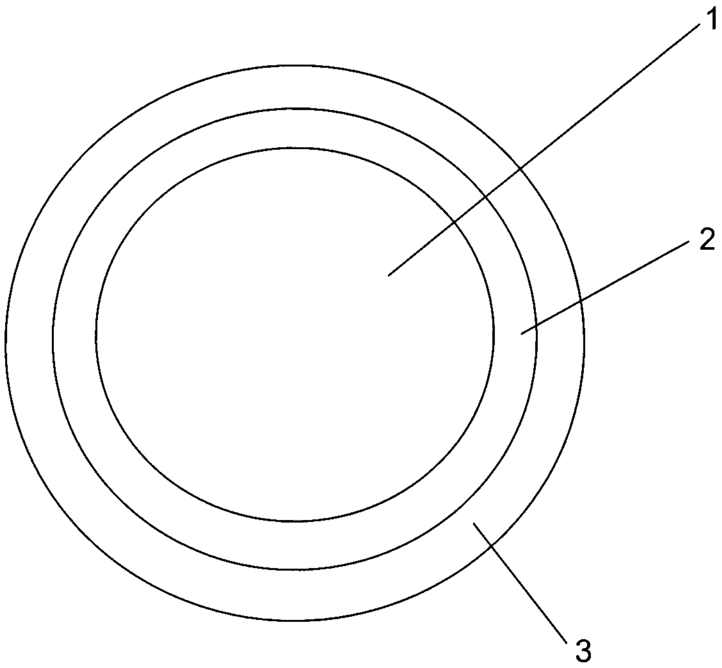
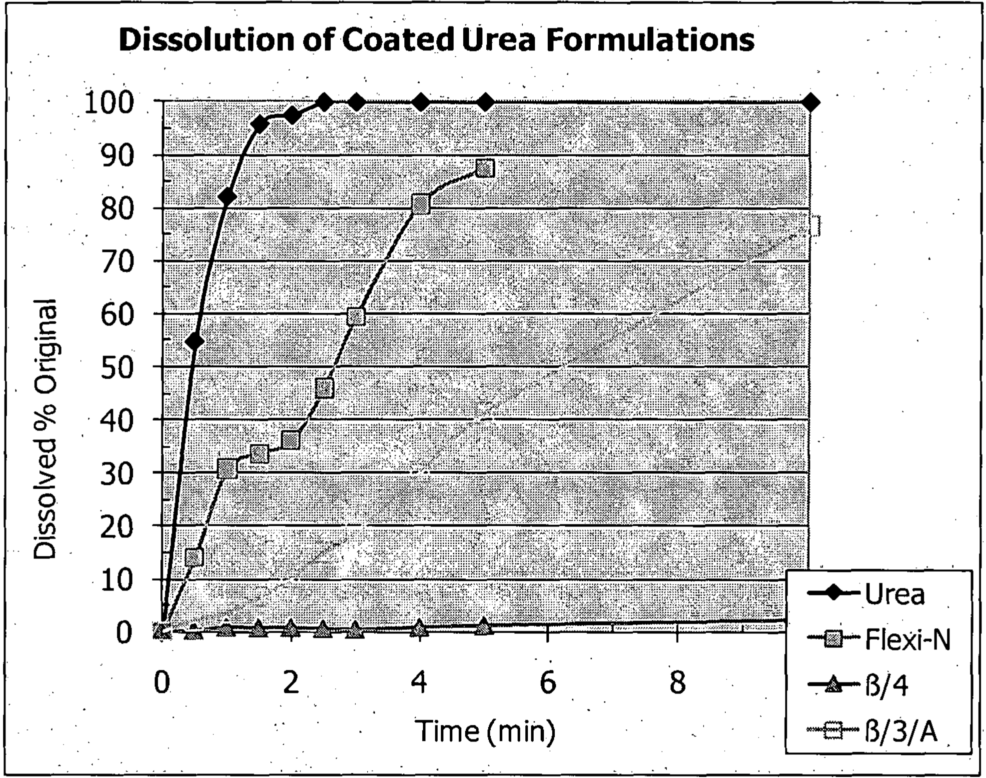


Figure 2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80
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50
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ß/4
ß/3/A

Figure 3

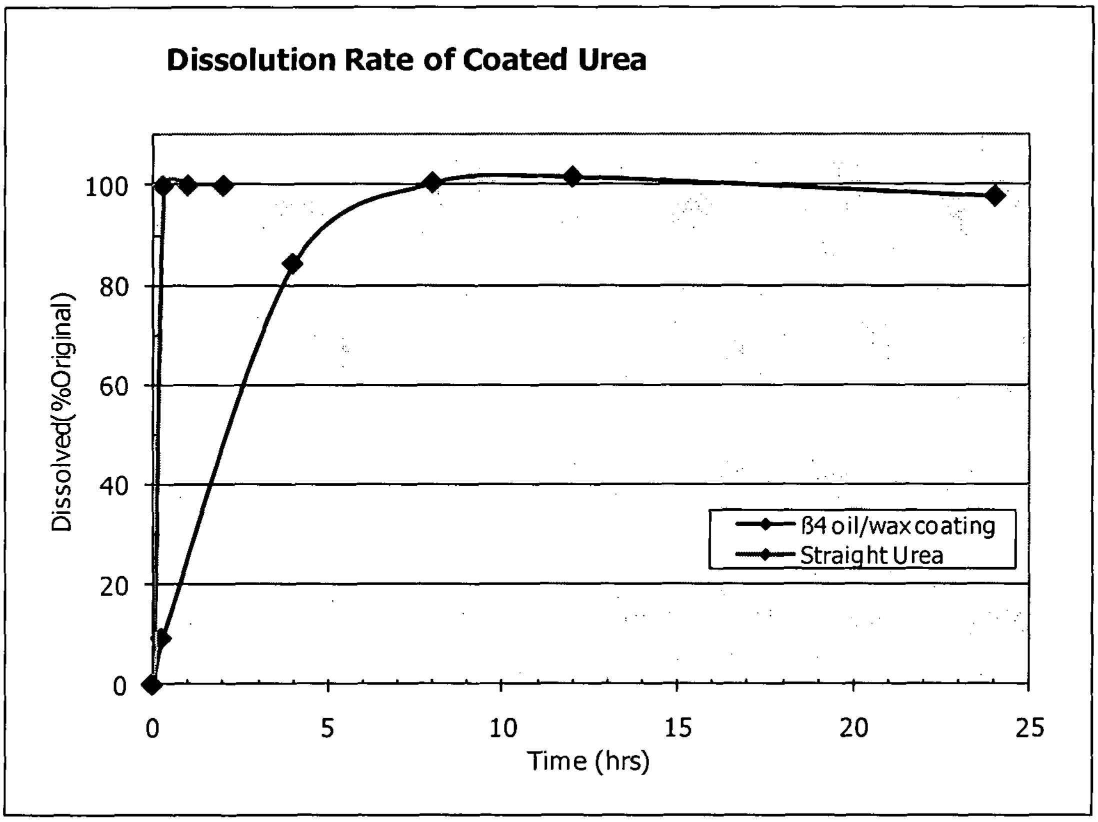
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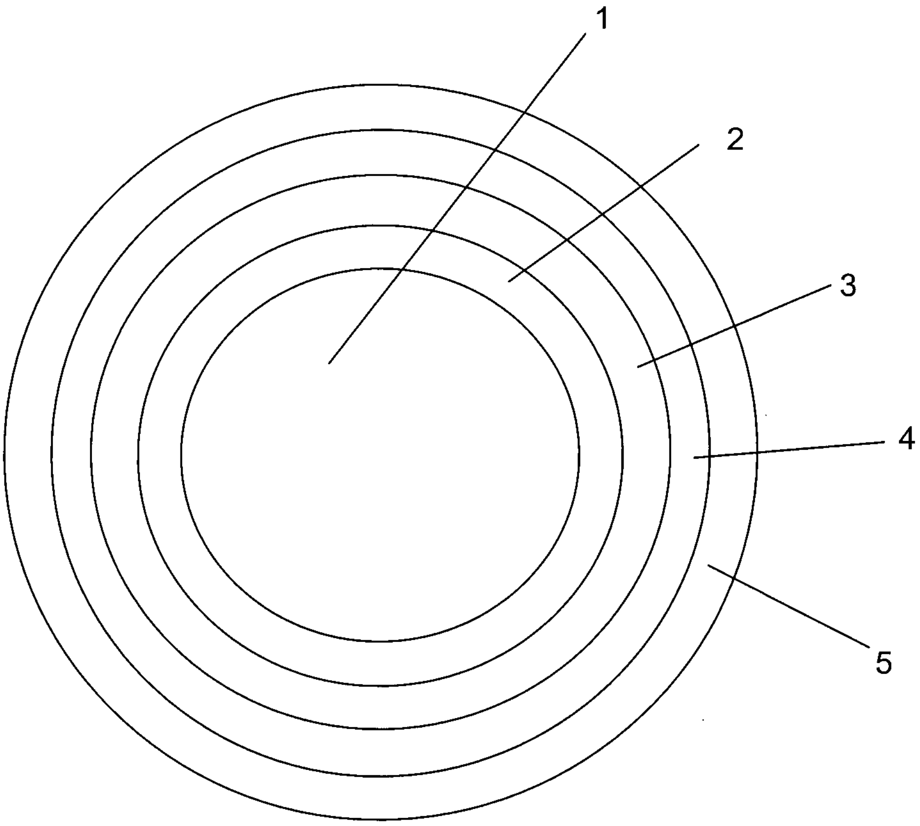
Figure 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2012/000102

A. CLASSIFICATION OF SUBJECT MATTER

C05C 9/00 (2006.01) C05B 1/00 (2006.01) C05G 1/00 (2006.01) C09D 191/00 (2006.01) C09D 193/00 (2006.01) C05G 5/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPOQUE (Epodoc, Medline, WPI) & STN (WPIDS, Biosis, Agricola) & keywords: fertiliser, urea, mineral, polyphosphate, sulfate, potassium chloride, phosphorous, nitrogn, potassium, core, granule, chip, grain, pellet, particle, nucleus, coat, layer, encapsulate, plant based oil, plant oil, vegetable oil, linseed oil, olive oil, peanut oil, canola oil, wax, resin, trace element, magnesium, copper, silicon, boron, selenium, zinc, iron, manganese, calcium, silicon dioxide, magnesium dioxide & synonyms & like terms.

Goggle Patents, Patent Lens: fertiliser, oil, wax, coat, trace element, granule, vegetable oil, resin & like terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

☒ Further documents are listed in the continuation of Box C ☒ See patent family annex

*	Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 5 October 2012	Date of mailing of the international search report 05 October 2012
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au Facsimile No.: +61 2 6283 7999	**Authorised officer** Corrina Parker AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262223661

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT	International application No. **PCT/NZ2012/000102**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	abstract; examples 6-8; paragraphs 0018-0019, 0044	1-4
	US 4657576 A (LAMBIE, J.M.H.) 14 April 1987	
X	abstract; claims 22-28	1-3
Y	abstract; claims 22-28	7-9,11
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Y	abstract; column 2, lines 24-25; example 1	9
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Y	abstract; column 2, lines 41-42	9
	US 3259482 A (HANSEN, L.I.) 05 July 1966	
X	columns 1 and 3; column 2, lines 24-30; column 4, line 71 – column 5, line 2	5,6,10
Y	columns 1 and 3; column 4, line 71 – column 5, line 2	7-9,11

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/NZ2012/000102**

Patent Document/s Cited in Search Report		**Patent Family Member/s**	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/NZ2012/000102**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		**Patent Family Member/s**	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
		US 5603745 A	18 Feb 1997
		WO 9600199 A1	04 Jan 1996
		ZA 9505152 A	31 Jan 1996
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End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.