



(51) International Patent Classification:

C05D 1/00 (2006.01) *C05G 3/04* (2006.01)
C05G 3/00 (2006.01) *C05G 3/06* (2006.01)
C05G 3/02 (2006.01)

(21) International Application Number:

PCT/NZ2015/050140

(22) International Filing Date:

11 September 2015 (11.09.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

631396 12 September 2014 (12.09.2014) NZ

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(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every

kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: FERTILIZER COATED WITH LINEAR ALCOHOL ETHOXYLATE AND OPTIONALLY RAW PLANT OIL

(57) Abstract: The invention concerns the use of linear alcohol ethoxylates (LAEs) to coat fertilizer granules and chips. The LAE may be used as a carrier for trace elements. The coating composition may also contain a 1 : 1 blend of LAE with raw plant oil.



WO 2016/039645 A1

FERTILIZER COATED WITH LINEAR ALCOHOL ETHOXYLATE AND OPTIONALLY RAW PLANT OIL

TECHNICAL FIELD

The present invention relates to improvements in and relating to fertiliser and like compositions and the manufacture thereof. 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 primarily in relation to phosphate fertilisers. 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 phosphate fertilisers should not be seen as limiting.

When fertilisers are being applied to an area of land it is often useful to at the same time also apply other trace elements to the soil which are beneficial for plant growth or animal health. Ideally to make this a one step process the trace elements are coated onto a fertiliser granule or chip for delivery to the land at the same time as the fertiliser. However, phosphate fertilisers can chemically react with the trace elements. In order to overcome this problem US 20110214465 teaches the use of a barrier coating in between the fertiliser granule or chip and the coating layer containing the trace elements.

Another problem with fertilisers is that the granules or chips can - when they contact one another during transportation, or handling - produce a lot of dust which, is problematic and can clog agricultural equipment and also be a health risk if inhaled. However, when overcoming this problem and providing a dust suppressant, it is also important that the fertiliser granules or chips remain dry and free flowing and are not tacky or otherwise prone to agglomerating together.

Another problem that exists is the ability to hold trace elements in suspension in a coating composition, so that once a coating composition has been homogenised, the trace elements can be uniformly applied to fertiliser chips and granules during a coating process. It would also be useful to have a coating composition which can hold trace elements in suspension, for a period of time, after homogenization of the coating composition and trace elements therein – so

the coating composition can be made in advance of the time of actual use when it is applied to the fertiliser chips or granules.

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.

Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise", "comprising", and the like, are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense, that is to say, in the sense of "including, but not limited to".

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 'uncoated fertiliser' refers to uncoated granule or chip of fertiliser.

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

According to a first aspect of the present invention there is provided a coating composition which includes a linear alcohol ethoxylate together with raw plant oil.

Preferably, the ratio of linear alcohol ethoxylate to raw plant oil is 50:50.

According to a second aspect of the present invention there is provided a coating composition which includes 1 part linear alcohol ethoxylate and 1 part raw plant based oil together with 5 parts of at least one trace element which has an average particle size of less than 45 microns.

In some preferred embodiments the average particle size of the trace element may be between 2 – 10 microns.

Preferably, the average particle size of the trace element may be substantially 2 microns.

According to a third aspect of the present invention there is provided a fertiliser composition which includes a core in the form of a granule or chip which is coated with a layer comprising a mixture of a linear alcohol ethoxylate together with raw plant oil.

According to a fourth aspect of the present invention there is provided a fertiliser composition substantially as described above wherein the mixture also includes one or more trace elements therein.

According to a fifth aspect of the present invention there is provided use of LAE as a coating composition on fertiliser granules or chips.

According to a sixth aspect of the present invention there is provided use of LAE to apply trace elements to fertiliser granules or chips.

According to a seventh aspect of the present invention there is provided slurry comprising LAE together with a blend of a fertiliser granule or chip and at least one trace element having an average particle size of less than 45 microns.

BEST MODES FOR CARRYING OUT THE INVENTION**Example 1: LAE (1.4% per tonne)**

This composition according to the present invention is made by adding trace elements in the form of copper and zinc 2 micron powder to Linear Alcohol Ethoxylate in the amounts indicated below:

4kg Linear Alcohol Ethoxylate

4kg Cuprous Oxide sub 2 micron (Commercial name Nordox) powder

6kg Zinc Oxide sub 45 micron (Commercial name White Seal) powder

The inventors have found this is the minimum level of LAE required in order to get this quantity of trace element powder into the LAE solution.

Due to the low surface tension of LAE the granular coverage is much greater with LAE than say a similar water based solution - (i.e. more water would be needed to achieve the same effect).

This product is H₂O free which prevents ammonia from being released (Health and Safety) and also prevents an ammonia reaction with the zinc and copper micro-nutrients.

The inventors have found that over the period of 30 days the copper and zinc powder remained in suspension in a sealed container. When exposed to air (without a lid) there is little change in viscosity or suspension.

By way of contrast adding the same powders to H₂O in a sealed container and the powders will completely settle within 30 days. Unsealed, water will full hydrate out within 30 days at 20c 70% Relative Humidity.

The Advantage of LAE vs water (H₂O) based suspension is that when the lid is removed the water hydrates out leaving the mixture hard and unworkable.

Also Cuprous oxide when in water begins to create a "skin" on the top of the mixture. This still occurs (Within 48 hours) when sealed and air removed. The H₂O free LAE mixture isn't effected, by this skinning effect (This is a major benefit)

Example 2: LAE / Canola Oil 50/50 at (1.4% per tonne)

This composition according to the present invention is made by adding trace elements in the form of copper and zinc powder to a mixture of raw Canola Oil and Linear Alcohol Ethoxylate in the amounts indicated below:

2kg raw Cold Pressed Canola Oil

2kg Linear Alcohol Ethoxylate

4kg Cuprous Oxide sub 2 micron (Commercial name Nordox) powder

6kg Zinc Oxide sub 45 micron (Commercial name White Seal) powder

Adding of the Canola Oil reduces cost compared to just using LAE alone as per Example 1, yet still removes the need for H₂O to be present.

The LAE is still needed to “Dry” the coating.

If you increase the Canola Oil ratio past the 1:1 ratio with LAE the product becomes too “oily” and will remain tacky (Not desired).

As with Example 1 the inventors have found that over the period of 30 days the copper and zinc powder remained in suspension in a sealed container. When exposed to air (without a lid) there is little change in viscosity or suspension.

Example 3: LAE (0.3% per tonne) and trace elements coating DAP

4kg Cuprous Oxide sub 2 micron (Commercial name Nordox)

6kg Zinc Oxide sub 45 micron (Commercial name White Seal) powder

3kg LAE

987kg DAP granules

In this example the Zinc Oxide powder and the Cuprous Oxide powder are blended together along with DAP before LAE is added and mixed into the blend to attach the trace elements to the outside of the granule.

Example 4: LAE / Palm Oil 50/50 at (1.4% per tonne)

This composition according to the present invention is made by adding trace elements in the form of magnesium and zinc powder to a mixture of raw Palm Oil and Linear Alcohol Ethoxylate in the amounts indicated below:

2kg raw Palm Oil

2kg Linear Alcohol Ethoxylate

4kg Boron or elemental Sulphur

6kg Zinc Oxide sub 45 micron (Commercial name White Seal) powder

If you increase the Canola Oil ratio past the 1:1 ratio with LAE the product becomes too “oily” and will remain tacky (Not desired).

Example 5: DAP coated with LAE/ Canola and Zinc and Copper

Here 998kg of DAP is mixed with 2kg of composition in Example 2 in a rotary mixer to form a coating over the DAP which contains trace elements.

ALTERNATE WAYS TO IMPLEMENT THE INVENTION

The raw plant oil may be any plant oil provided it doesn't react with urea or other acidulated fertilisers. The inventors have found that “refined” plant oils do not work as well as raw oils. As the refining and bleaching process (used on plant oils typically for food production) removes the natural waxes and hardeners in the oil that help the drying process when applied to a fertiliser.

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

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

The plant oil may also be selected from any one of the following:

- Sunflower oil;
- Palm oil;
- Soy bean oil;
- Canola oil;
- Olive oil;
- Sesame seed oil; and
- Peanut oil.

However, this list should not be seen as limiting as other similar plant based oils may also be suitable.

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;
- Sulphur;
- Selenium;
- Zinc;
- Iron;
- Manganese;
- Iodine; and
- Calcium.

However this list is not exhaustive. The purpose of the trace elements is in many cases 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.

The particle size of the trace elements may be selected from 2,3,4,5,6,7,8, 9 or 10 microns. The exact particle size may depend on the trace element being used.

In one preferred embodiment the powdered trace element may be in the form of magnesium oxide having an average particle size of less than 45 microns.

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; and

- Carbon.

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.

It should be noted that carbon can as well as forming a core also be used in powdered form having an average particle size of less than 45 microns in a manner similar to trace elements such as MgO.

In some preferred embodiments the fertiliser 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.
- Granular DAP;
- Granular MAP;
- Granular Super Phosphate / Triple Super Phosphate;
- Granular MOP;
- Magnesium Oxide Chip average particle size of 45 micron or above; and
- Lime Chip.

Again this list is not intended to be exhaustive.

In general the fertiliser chips or granules will have an average particle size of 2-4mm but occasionally up to 10mm.

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.

The acrylic emulsion may be PRIMAL™ – E-1764K Acrylic Emulsion Polymer from ROHM HAAS. Other acrylic emulsions are envisaged which have similar characteristics to PRIMAL™ Acrylic Emulsion Polymer.

The entire disclosures of all applications, patents and publications cited above and below, if any, are herein incorporated by reference.

Reference to any prior art in this specification is not, and should not be taken as, an acknowledgement or any form of suggestion that that prior art forms part of the common general knowledge in the field of endeavour in any country in the world.

The invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, in any or all combinations of two or more of said parts, elements or features.

Where in the foregoing description reference has been made to integers or components having known equivalents thereof, those integers are herein incorporated as if individually set forth.

It should be noted that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications may be made without departing from the spirit and scope of the invention and without diminishing its attendant advantages. It is therefore intended that such changes and modifications be included within the present invention.

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 coating composition which includes a 1:1 mixture of a linear alcohol ethoxylate together with raw plant oil.
2. A coating composition which includes 1 part linear alcohol ethoxylate and 1 part raw plant based oil together with 5 parts of at least one trace element which has an average particle size of less than 45 microns.
3. A coating composition as claimed in claim 2 wherein the trace element has an average particle size of substantially between 2 – 10 microns.
4. A coating composition as claimed in claim 3 wherein the trace elements have an average particle size of between 2 – 10 microns.
5. A coating composition as claimed in claim 4 wherein the trace elements have an average particle size of substantially 2 microns.
6. A fertiliser composition which includes a core in the form of a granule or chip which is coated with a layer comprising a mixture of a linear alcohol ethoxylate together with raw plant oil.
7. A fertiliser composition as claimed in claim 6 wherein the mixture also includes one or more trace elements therein.
8. Use of LAE as a coating composition on fertiliser granules or chips.
9. Use of LAE to apply trace elements to fertiliser granules or chips.
10. A slurry comprising LAE together with a blend of a fertiliser granule or chip and at least one trace element.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ2015/050140

A. CLASSIFICATION OF SUBJECT MATTER

C05D 1/00 (2006.01) C05G 3/00 (2006.01) C05G 3/02 (2006.01) C05G 3/04 (2006.01) C05G 3/06 (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)

Chemical Abstracts (CAPLUS), keywords for alcohol ethoxylates and fertilizers; Derwent Abstracts (WPIAP) IPC C05/ic and kw for alcohol ethoxylates; USPTO Full Text applications and Google, keywords for fertilizers, alcohol ethoxylates and vegetable/plant oils. Applicant and inventor names in Espacenet, Google and IPAustralia internal databases.

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
16 November 2015Date of mailing of the international search report
16 November 2015

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INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/NZ2015/050140
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5472631 A (HARRIS) 05 December 1995 Abstract, examples	1
X Y	US 7022651 B1 (LIGHTCAP et. al.) 04 April 2006 Abstract, examples, column 4 lines 53-57 Abstract, examples	1 2-10
X Y	US 6689720 B2 (WOZNICA et. al.) 10 February 2004 Abstract, examples, claim 1, column 3 lines 59-62, column 4 lines 58-61, column 6 lines 26-27. Abstract, examples	1 2-10
X	US 2012/0045587 A1 (SHAROYAN et. al.) 23 February 2012 Abstract, claim 1, paragraph 0043, examples.	1
X Y	WO 1996/023746 A1 (LATTING et. al.) 08 August 1996 Abstract, examples. Abstract, examples.	8 8-10
X Y	US 2003/0164015 A1 (PILDYSH) 04 September 2003 Abstract, examples Abstract, examples	8 8-10
X Y	US 2011/0302975 A1 (ANTENS et. al.) 15 December 2011 Abstract, examples Abstract, examples	8-10 8-10
A	Anon., "Stepan Product Bulletin BIO-SOFT® N1 SERIES", Stepan Company (2014), Retrieved from the Internet 5 November 2015, URL: http://www.stepan.com/uploadedFiles/Literature_and_Downloads/Product_Bulletins/Surfactants/BIO-SOFT%C2%AE/BIOSOFTN1SERIES.pdf Whole document	8-10
Y	WO 2013/019121 A1 (SOUTH STAR FERTILIZERS LIMITED) 07 February 2013 Abstract, examples.	2-10

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including
2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Supplemental Box for Details

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

Supplemental Box**Continuation of: Box III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

1. Claims 1-7 are directed to coating compositions comprising raw plant oil and linear alcohol ethoxylates, and fertilizers coated with such compositions.. The feature of the provision of a combination of raw plant oil and linear alcohol ethoxylate in a coating composition is specific to this group of claims.
2. Claim 8 is directed to the use of linear alcohol ethoxylate to coat fertilizer granules or chips.. The feature of the use of linear alcohol ethoxylate in a coating to fertilizer is specific to this claim.
3. Claim 9 is directed to use of linear alcohol ethoxylate to apply trace elements to fertilizer granules or chips (not necessarily as a coating). The feature of the use of linear alcohol ethoxylate to provide trace elements to a fertilizer is specific to this claim.
4. Claim 10 is directed to a slurry of linear alcohol ethoxylate with a fertilizer granule or chip and at least one trace element. The feature of the provision of linear alcohol ethoxylate in a slurry with a fertilizer and one or more trace elements is specific to this claim.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

The only feature common to all of the claims is the provision of linear alcohol ethoxylate in a coating, which is known, for example, from the citations reported in this report.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a posteriori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/NZ2015/050140

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 5472631 A	05 December 1995	US 5472631 A	05 Dec 1995
US 7022651 B1	04 April 2006	US 7022651 B1	04 Apr 2006
US 6689720 B2	10 February 2004	US 2003104947 A1	05 Jun 2003
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		EP 1023247 B1	23 Oct 2002
		JP 2001515837 A	25 Sep 2001
		US 5679128 A	21 Oct 1997

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

Form PCT/ISA/210 (Family Annex)(July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/NZ2015/050140

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 5964917 A	12 Oct 1999
		US 6358294 B1	19 Mar 2002
		WO 9912869 A1	18 Mar 1999

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

Form PCT/ISA/210 (Family Annex)(July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/NZ2015/050140

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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.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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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.

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