

A METHOD OF MAKING A LIQUID FERTILIZING SUBSTANCE

THIS INVENTION relates to fertilizing. It relates, in particular, to a method of making a liquid fertilizing material, to a method of making a liquid fertilizer blend, to a liquid fertilizing material, to a liquid fertilizer blend and to a method of
5 fertilizing a plant.

According to a first aspect of the invention there is provided a method of making a liquid fertilizing material, the method including the steps of
preparing an extract of a natural organic material; and
combining the extract with a fertilizing substance.

10 The natural organic material may be a natural organic fertilizing material. The natural organic material may include animal droppings. It may, for example, be manure or droppings such as sea-bird guano or chicken manure.

The extract may be an aqueous extract. Thus, preparing the extract of the natural organic material may include the step of extracting the natural organic
15 fertilizing material with water in an aqueous mixture by admixing it with water to produce an aqueous mixture containing an aqueous phase and insoluble material and agitating or stirring the mixture. Instead, preparing the extract may include the step of extracting the natural organic fertilizing material with an aqueous solution of a base in an aqueous mixture. The base may be selected from sodium hydroxide and
20 potassium hydroxide. Typically the amount of base used is about 1,5-3,0% by mass based on the total volume (ie m/v). Thus for example, for an aqueous mixture of 20000ℓ containing 10 tons of the natural organic material and 10000ℓ of water, potassium hydroxide in an amount of about 300-600g would typically be used. Thus the base may comprise about 1,5-3,0% by mass based on the total volume of the
25 aqueous solution and the natural organic fertilizing material. The use of potassium hydroxide results in a temperature increase in the aqueous mixture to about 40° if about 1,5% (m/v) of potassium hydroxide is used and to about 60° if about 3,0% (m/v) of potassium hydroxide is used. Typically the extraction is conducted at a pH of about 5,0 - 6,5.

30 The potassium or sodium hydroxide present in the aqueous mixture also serves to hydrolyse proteins present in the mixture to amino acids. Typically about 60% of the protein present is hydrolysed. The base also aids in the extraction of

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carbon containing material from the natural organic material. Typically about 80% of the carbon containing material present in the natural organic material is extracted. The chelation effect, discussed in further detail below, is also enhanced by the presence of potassium or sodium hydroxide.

5 The extraction step may be carried out at an elevated temperature. It may, for example, be carried out at a temperature of about 60 - 90°C, preferably about 75 - 85°C. The extraction step may be carried out over a period of about 15 - 40 minutes.

10 Preparing the extract may include, after the extraction step, the step of removing the insoluble material from the aqueous mixture to produce an aqueous phase. The insoluble material may be removed by passing the mixture through a cyclone in order to separate the bulk of the insoluble material from the aqueous phase and passing the aqueous phase through a filter press to produce a filtered aqueous phase. Naturally any other suitable method may be used to separate the insoluble material from the
15 aqueous mixture.

 Preparing the extract may include the further step of partially evaporating or concentrating the aqueous phase to produce the extract. Typically, the filtered aqueous phase will be concentrated until, or to produce, an extract with a carbon:nitrogen ratio of 24:1. Thus, the method may include the step of concentrating
20 the aqueous phase until the extract has a carbon:nitrogen ratio of about 24:1. When this ratio is achieved, essentially all excess water will have evaporated and just sufficient water will remain to dissolve most of the soluble material in the extract.

 The extract will typically have a dissolved solids content of about 35% (m/m).

25 The fertilizing substance may be selected from water-soluble salts and mixtures of water-soluble salts. The water soluble salts may be salts of metals selected from the group which includes calcium, magnesium, potassium, ammonium and the like and anions selected from the group consisting of nitrate, acetate, chloride, sulphate, phosphate and the like.

30 Combining the extract with the water soluble salt or mixture of water soluble salts may include the prior step of at least partially dissolving the water soluble salt or mixture of water soluble salts in water to obtain an at least partial solution and

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combining the at least partial solution with the extract. The combining step may include heating the resulting combination to bring about further dissolution of any undissolved fertilizing substance. It may involve the further step of allowing the combination to stand for a period of about 24 hours.

5 Prior to combining the solution of fertilizing substance(s) with the extract to produce the liquid fertilizing material, the concentration of the at least partial solution may be between about 35 g/l and 80 g/l depending upon the solubility of the fertilizing substance.

10 For example, in the case of calcium nitrate and calcium acetate, the concentration may be between about 53 and 64 g/l, preferably about 56 g/l. In the case of magnesium nitrate the concentration may be between about 33 and 38 g/l preferably about 35 g/l. In the case of potassium nitrate, potassium chloride and potassium sulphate the concentration may be between about 65 and 80 g/l preferably about 75 g/l. In the case of ammonium nitrate, ammonium sulphate and
15 urea ammonium nitrate the concentration may be between about 85 and 95 g/l preferably about 90 g/l. In the case of monoammonium phosphate, diammonium phosphate, monopotassium phosphate and dipotassium phosphate the concentration may be between about 30 and 40 g/l preferably about 35 g/l.

20 The volume ratio between the extract and the at least partial solution of fertilizing substance may be about 1:4.

 The method may include the further step of combining a micro-nutrient blend with the extract and the fertilizing substance. The micro-nutrient blend may include elements selected from the group which includes zinc, copper, manganese, iron, molybdenum, boron and mixtures of any two or more thereof. The micro-nutrient
25 blend may be BMX supplied by Chemserve Colloids (Pty) Limited.

 The invention extends to a method of making a liquid fertilizer blend which includes the step of combining or blending at least two liquid fertilizing materials each prepared according to the method as hereinbefore described.

30 The method may include combining or blending predetermined quantities of the liquid fertilizing materials to produce a blend containing a plurality of fertilizing substances each present in a predetermined amount.

 Thus the method may be used to make mixtures or blends, each

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containing predetermined amounts of different fertilizing substances, selected to suit, for example, the requirements of a particular type of crop or plant or the requirements of a particular kind of crop or plant at a particular stage of its growth.

Surprisingly, the Applicant has found that the method of the invention
5 allows a blend of liquid fertilizing materials to be prepared which blend contains fertilizing substances which, if they were merely dissolved in water, would normally result in the formation of a precipitate. So, for example, a liquid fertilizing material containing calcium, prepared in accordance with the method of the invention, can be blended with another liquid fertilizing material containing, for example, phosphate,
10 sulphate or carbonate without the expected precipitation of calcium sulphate, calcium phosphate or calcium carbonate.

The invention extends to a liquid fertilizing material made in accordance with the method as hereinbefore described.

The invention extends, further, to a liquid fertilizer blend made in
15 accordance with the method as hereinbefore described.

The invention extends, further, to a method of fertilizing a plant, the method including the step of applying to the plant an effective amount of a fertilizer selected from liquid fertilizing materials and liquid fertilizer blends as hereinbefore described and mixtures of any two or more thereof.

20 In the case of fruit-bearing citrus trees, the method may include applying the liquid fertilizing material or liquid fertilizer blend by means of a knapsack spray, by flood irrigation, by overhead irrigation, by micro-irrigation or by the use of a drip system.

The invention is now described, by way of example, with reference to
25 the accompanying Examples.

EXAMPLE 1

In order to prepare the extract, chicken manure (1kg) was added to water (1.5ℓ) and the mixture was heated to 80°C, with stirring, for 30 minutes. The resulting mixture, comprising an aqueous phase and insoluble material, was passed through a
30 cyclone to separate insoluble material from the mixture. The aqueous phase was then passed through a filter-press to remove remaining suspended solid material.

The extract was produced by concentrating the filtered aqueous phase to

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a volume of about 1ℓ. The extract had a carbon:nitrogen ratio of 24:1 and contained about 35%(m/m) dissolved solids.

In a separate run, potassium hydroxide (50g) was added to the mixture. The addition of the potassium hydroxide resulted in an initial temperature increase to
5 40°C.

EXAMPLE 2

A liquid fertilizing material containing the fertilizing substance calcium nitrate was made as follows. A solution of calcium nitrate was prepared by dissolving calcium nitrate (53g) in water (100 mℓ) to produce a solution having a concentration of
10 53 % (m/v). The solution (100 mℓ) was then admixed with the extract of Example 1 (400 mℓ) (the ratio between the extract and the calcium nitrate solution thus being 1:4). The resulting mixture was heated to 60°C and left to stand for 24 hours to produce the liquid fertilizing material containing the fertilizing substance calcium nitrate.

The process of Example 2 was repeated using the fertilizing substance
15 calcium acetate (53 g) and the same quantities of water and extract to produce a liquid fertilizing material containing the fertilizing substance calcium acetate.

The calcium-containing liquid fertilizing material(s) can be blended with other liquid fertilizing materials (prepared as described below), or with other nutrients, to form a fertilizer blend or fertilizer which is suited to the requirements of a particular
20 crop. The calcium-containing liquid fertilizing material can, instead, be used directly, as a calcium source, through an irrigation system or as a foliar feed to overcome specific calcium deficiencies (detected for example by leaf analysis) that may occur during the growing season of a plant.

EXAMPLE 3

A liquid fertilizing material containing the fertilizing substance
25 magnesium nitrate was prepared as follows. A solution of magnesium nitrate was prepared by dissolving magnesium nitrate (35 g) in water (100 mℓ) to produce a solution having a concentration of 35% (m/v). The solution (100 mℓ) was then admixed with the extract of Example 1 (400 mℓ) (the ratio between the extract and the
30 calcium nitrate solution thus being 1:4) and the resulting mixture was left to stand for 48 hours to produce the liquid fertilizing material containing the fertilizing substance magnesium nitrate.

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The magnesium-containing liquid fertilizing material can be used in blends, as described above, directly through irrigation systems or as a foliar feed in the case of magnesium deficiencies in a plant (for example as detected by tissue analysis).

EXAMPLE 4

5 A liquid fertilizing material containing the fertilizing substance potassium nitrate was prepared as follows. A solution of potassium nitrate was prepared by dissolving potassium nitrate 1kg in water 600ml at 70 - 90°C with mechanical stirring for 5 - 10 minutes to produce a solution having a concentration of 62,5% (m/m). The resulting solution (100 ml) was admixed with the extract of Example 1 (400 ml) (the
10 ratio between the extract and the potassium nitrate solution thus being 1:4) to produce the liquid fertilizing material containing the fertilizing substance potassium nitrate.

 The process of Example 4 was repeated twice more using, respectively, the fertilizing substances potassium chloride and potassium sulphate in the same quantities to produce liquid fertilizing materials containing the fertilizing substances
15 potassium chloride and potassium sulphate respectively.

 The potassium-containing liquid fertilizing material(s) can be blended with other liquid fertilizing materials or nutrients, as described above, or used on its own and applied through irrigation systems or as a foliar feed.

EXAMPLE 5

20 A liquid fertilizing material containing the fertilizing substance ammonium nitrate was prepared as follows. A 21% (m/m) solution of ammonium nitrate (100 ml) was admixed with the extract of Example 1 (400 ml) (the ratio between the extract and the ammonium nitrate solution thus being 1:4) and the resulting mixture was left to stand for 24 hours to produce the liquid fertilizing material
25 containing the fertilizing substance ammonium nitrate.

 The process of Example 5 was repeated twice more using, respectively, the fertilizing substances ammonium sulphate as an 80% (m/m) solution and urea ammonium nitrate as an 80% (m/m) solution in the same quantities to produce liquid fertilizing materials containing the fertilizing substances ammonium sulphate and urea
30 ammonium nitrate respectively.

 The ammonium-containing liquid fertilizing material(s) can be blended with other liquid fertilizing materials or nutrients, as described above, or used on its

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own through an irrigation system or as a foliar feed in prescribed quantities.

EXAMPLE 6

A liquid fertilizing material containing the fertilizing substance monoammonium phosphate was prepared as follows. A 30% (m/m) solution of monoammonium phosphate (100 ml) was admixed with the extract of Example 1 (400 ml) (the ratio between the extract and the monoammonium phosphate solution thus being 1:4) and the resulting mixture was mechanically stirred for 5 minutes and left to stand for 48 hours to produce the liquid fertilizing material containing the fertilizing substance monoammonium phosphate.

The process of Example 6 was repeated three times using, respectively, the fertilizing substances diammonium phosphate, monopotassium phosphate and dipotassium phosphate, each as a 30% (m/m) solution, in the same quantities to produce liquid fertilizing materials containing the fertilizing substances diammonium phosphate, monopotassium phosphate and potassium phosphate.

The phosphate-containing liquid fertilizing material(s) can be blended with other liquid fertilizing materials or nutrients as described above to suit the requirements of a specific crop or area or used on its own through irrigation systems or as a foliar feed to overcome phosphate deficiencies (for example as detected by tissue analysis).

EXAMPLE 7

A liquid fertilizer blend was prepared by admixing the potassium-containing liquid fertilizing material of Example 4 (20kg) with the ammonium-containing liquid fertilizing material of Example 5 (40kg), the phosphate-containing liquid fertilizing material of Example 6 (33kg) and BMX micro-nutrient blend (0,2kg), supplied by Chemserve Colloids (Pty) Limited, to produce the liquid fertilizer blend.

EXAMPLE 8

A liquid fertilizer blend was prepared by admixing the potassium-containing liquid fertilizing material of Example 4 (20kg), the ammonium-containing liquid fertilizing material of Example 5 (61kg), the calcium-containing liquid fertilizing material of Example 2 (7,3kg), the magnesium-containing liquid fertilizing material of Example 3 (2,5kg) and BMX

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micro-nutrient blend (0,2kg), to produce the liquid fertilizer blend.

Liquid fertilizers, ie fertilizers containing dissolved fertilizing components in an aqueous medium, generally cannot be produced by combining calcium-containing fertilizing materials with many other fertilizing materials because of the tendency of calcium salts to precipitate from the aqueous medium. For example, calcium salts cannot be combined, in liquid fertilizers, with phosphates, sulphates (such as ammonium sulphate or magnesium sulphate) or carbonates because of precipitation of calcium phosphate (for example as tricalcium phosphate) calcium sulphate or calcium carbonate. Even when a soluble calcium salt is applied to the soil, for example as a component of a top-dressing, the soluble calcium salt can be converted, in the soil, into insoluble calcium carbonate or calcium hydroxide. This limits the availability of the calcium of the soluble calcium salt to plants growing in the soil. Magnesium-containing salts can similarly be converted, in the soil, to partly-soluble magnesium carbonate or magnesium hydroxide so that the availability of the magnesium of the soluble magnesium salt to plants growing in the soil is also limited.

It is an advantage of the invention described that it provides a liquid fertilizing material which contains fertilizing substances which normally would produce precipitates if merely dissolved in water. Without being bound by theory, the Applicant believes that a chelation process takes place in which at least the cations of the fertilizing substances are collated by substances extracted from the natural organic material. This chelation process is believed to be responsible for preventing precipitation from taking place. The Applicant further believes that the chelation process also prevents the fertilizing substances from being leached from the soil.

It is a further advantage of the invention described that predetermined amounts of different liquid fertilizing materials may be blended to provide a blend having predetermined amounts of different fertilizing materials present. This permits the preparation of liquid fertilizer blends which are suited to the requirements of different plants or to the requirements of a specific plant during different periods of its growth cycle. For example, some plants require certain nutrients during their growth stage and other nutrients during their reproduction stage. The invention thus provides blends which can be applied to the ground in the vicinity of the plant during these

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stages. Furthermore, prior art organic fertilizers of which the Applicant is aware do not contain large amounts of micro-nutrients. It has thus generally been necessary to use relatively large amounts of such prior art organic fertilizers in order to provide sufficient micro-nutrients to meet the requirements of a particular type of plant. It is

5 an advantage of the invention described that it provides a liquid fertilizing material which includes relatively large amounts of micro-nutrients so that it is not necessary to use large quantities of the liquid fertilizing material in order to provide adequate micro-nutrients to a plant.



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CLAIMS

1. A method of making a liquid fertilizing material, the method including the steps of
5 preparing an extract of a natural organic material; and
combining the extract with a fertilizing substance.
2. A method as claimed in Claim 1, in which the natural organic material is a natural organic fertilizing material.
3. A method as claimed in Claim 2, in which the natural organic fertilizing material includes animal droppings.
- 10 4. A method as claimed in Claim 2, in which preparing the extract of the natural organic fertilizing material includes the step of extracting the natural organic fertilizing material with water in an aqueous mixture.
5. A method as claimed in Claim 2, in which preparing the extract of the natural organic fertilizing material includes the step of extracting the natural organic
15 fertilizing material with an aqueous solution of a base in an aqueous mixture.
6. A method as claimed in Claim 5, in which the base is selected from sodium hydroxide and potassium hydroxide.
7. A method as claimed in Claim 5, in which the base comprises 1,5 - 3,0% by mass based on the total volume of the aqueous solution and the natural
20 organic fertilizing material.
8. A method as claimed in Claim 4, in which the extraction step is carried out at a temperature of about 60 - 90 °C.
9. A method as claimed in Claim 5, in which the extraction step is carried out at a temperature of about 60 -90°C.
- 25 10. A method as claimed in Claim 4, in which the extraction step is carried out over a period of about 15 - 40 minutes.
11. A method as claimed in Claim 4, which includes, after the extraction step, the step of removing insoluble material from the aqueous mixture to produce an aqueous phase.
- 30 12. A method as claimed in Claim 11, which includes the further step of concentrating the aqueous phase to produce the extract.
13. A method as claimed in Claim 12, which includes the step of

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concentrating the aqueous phase until the extract has a carbon:nitrogen ratio of about 24:1.

14. A method as claimed in Claim 1, in which the fertilizing substance is selected from water-soluble salts and mixtures of water-soluble salts.
- 5 15. A method as claimed in Claim 14, in which the water-soluble salts are salts of metals selected from the group which includes calcium, magnesium, potassium and ammonium and anions selected from the group which includes nitrate, acetate, chloride, sulphate and phosphate.
16. A method as claimed in Claim 14, in which combining the extract with
- 10 the water soluble salt or mixture of water soluble salts includes the prior step of at least partially dissolving the water soluble salt or mixture of water soluble salts in water to obtain an at least partial solution and combining the at least partial solution with the extract.
17. A method as claimed in Claim 16, in which the concentration of the at
- 15 least partial solution is between 35 g/l and 80 g/l.
18. A method as claimed in Claim 16, in which the volume ratio between the extract and the at least partial solution is about 1:4.
19. A method as claimed in Claim 1, which includes the step of combining a micro-nutrient blend with the extract and the fertilizing substance.
- 20 20. A method as claimed in Claim 19, in which the micro-nutrient blend includes elements selected from the group which includes zinc, copper, manganese, iron, molybdenum, boron and mixtures of any two or more thereof.
21. A method of making a liquid fertilizer blend which includes the step of combining or blending least two liquid fertilizing materials each prepared
- 25 according to a method as claimed in Claim 1.
22. A liquid fertilizing material made in accordance with a method as claimed in Claim 1.
23. A liquid fertilizer blend made in accordance with a method as claimed in Claim 21.
- 30 24. A method of fertilizing a plant which includes the step of applying to the plant an effective amount of a fertilizer selected from liquid fertilizing materials prepared in accordance with a method as claimed in Claim 1 and liquid fertilizer blends

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prepared in accordance with a method as claimed in Claim 21.

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