

**UNITED STATES DEPARTMENT OF AGRICULTURE**  
**(USDA)**

**PETITION (2) of (2)**

FOR

INCLUSION OF A SPECIFIC SUBSTANCE in NOP.

Petitioner:

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WASHINGTON. DC. 20250-0268.

*Revision 1: September 1, 2015. New York. USA.*

*Revision 2: November 1, 2015. Sydney. Australia.*

*Revision 3: December 12, 2015. Sydney. Australia.*

*Revision 4: March 23, 2016. Sydney. Australia.*

**Context of this Petition.**

A letter from USDA dated 16 November 2015 guided us to rephrase Revision 2 of our Petition. The resulting Revision 3 of our Petition dated 12 December 2015 followed suggestions from USDA in their 16 November 2015 letter; at that time we addressed all items listed by USDA.

Following new suggestions from USDA dated 22 March 2016, we herewith forward Revision 4 of our Petition which now includes comments under items B2, B3, B4, B6, and B9.

The basic structure of NOP has been in existence for the past 20-25 years.

Despite significant advances in scientific knowledge over that period, NOP documentation has proved flexible and accommodating to emerging knowledge and has permitted the introduction of new, useful, synthetic substances for organic-certified crop production.

NOP serves as the model for OMRI which in turn is the parent-document for daughter - Organic Standards in Australia. This vertical integration is done so as to achieve 'equivalence' and this feature simplifies 'market access' for trade in organic-certified products around the world.

But there are problems with this structure and things can go wrong.

If it is the case that NOP does not have an explicit allowance for a substance, or if there is an omission - which we believe can be demonstrated - this feature is continued into OMRI - and into Australian Standards.

The Australian Standards are not complete with respect to substances required for manufacture of chelates; this has been traced 'upstream' to OMRI where there is a similar omission of use of an alkali to form a chelating agent; and in the originating documents, NOP has an implicit, but not an explicit, allowance for alkali-substances to form chelating agents.

In recognition of this situation, we forward this Petition seeking explicit approval for use of substances technically necessary to form chelates.

## **Item B1: Identification of the single substance in Petition (2).**

Petitioned single substance: **Ammonium glycinate.**

Synonym: glycine mono-ammonium salt

Function of substance:

Sequestration agent / precursor substance in the formation of an organo-metal complex.

Alternative common names for function of substance:

Chelating agent, complexing agent, chelant.

CAS Number: 29728 - 27 - 6

PubChem CID: 161644

Molecular weight: 92

Ammonium glycinate is an organic-chemistry salt and is formed in the liquid state by manufacturers intending to manufacture a "chelate"; to our knowledge, it is only sold in the solid state.

In liquid form, this specific single substance is intentionally further reacted in solution to form a “chelate” with one of 4 metal salts already approved by NOP - hence the common name ‘chelating agent’.

Note that a chelate is a ‘double-salt’ requiring both a metal salt and an organic-chemistry salt, the latter acting as the sequestration agent, or chelating agent, for the metal. The 4 trace metals whose salts are already approved in NOP are copper, iron, manganese and zinc.

*The terms ‘trace metal’ and ‘micronutrient’ are used interchangeably and the latter term is technically more correct with the former being immediately more recognisable.*

### **Item B2: Manufacturer’s Name address and telephone number.**

Alpha Chemicals Pty Ltd  
18 Inman Road,  
CROMER. NSW. 2099.  
AUSTRALIA.  
phone: + 61 2 9982 4622

### **Item B3: Intended use of the substance.**

Ammonium glycinate is formed and used by us as a liquid inside a reaction vessel. Ammonium glycinate, in our case, does not leave the reaction vessel and therefore it cannot possibly have contact with soil in the production process of organic-certified crops.

Inside the reaction vessel ammonium glycinate is a captured, completely contained, intermediate substance being a transient in the process of manufacturing a ‘chelate’. We are interested in ammonium glycinate merely for the beneficial expression of its properties as a ‘chelating agent’ for the manufacture of a chelate.

The use we make of this transient ammonium glycinate is exclusively that of a ‘sequestration agent’- also called ‘chelating agent’.

Once the chelating agent has formed a chelate with a metal salt, the process is irreversible; the chelate once formed shows none of the properties of the component ammonium glycinate or metal salt. The only substance which will reach the ground in crop production is the chelate, a substance which is part of the field known as ‘organo-metal complexes’.

It seems worthwhile to stress that a chelate cannot be formed without a chelating agent. The whole point of manufacturing and using a chelate is that a chelate has desirable properties of molecular stability in soils of high pH - a property not possessed by the substances currently approved as simple metal salts in NOP clause 205.601 (j) (6) (ii). In fact, NOP has approved of no substance, as at the time of writing, which is capable of delivering micronutrients in a soil with pH > ~ pH 6.5.

### **Item B4: A list of crops for which the substance will be used.**

Item B3 above defines the role of ammonium glycinate as an intermediate, meaning that it is not used at all on crops (except as a tightly bound part of a new and completely different substance called a chelate). Upon exercising its property as a chelating agent in a reaction vessel, the substance in this petition is no longer in existence, just as hydrochloric acid and sodium hydroxide are no longer in existence when they have completed a reaction to form table salt, sodium chloride.

Nevertheless, we follow the spirit of the enquiry of Item B4 by providing the following data:-

- the rate of use of chelates on crops is very small. This is because the requirement of crops for trace metals is itself very small.

- crops have different requirement for copper, iron, manganese and zinc. The variation and the small requirement can be seen by inspection of “removal rates” of trace metals as published in the technical literature.
- The following examples of removal rates are taken from “Havlin, J; “Soil Fertility and Fertilisers”, 7th edition:-
  - Maize at 3 tons / ha: Cu 12 grams, Mn 135 grams, Zn 40 grams removed per hectare.
  - Sunflower at 1 ton / ha: Cu 7 grams, Mn 30 grams, Zn 25 grams removed per hectare.
  - Onion at 6 tons / ha: Cu 4 grams, Mn 36 grams, Zn 30 grams removed per hectare.
  - Oranges at 56 tons / ha: Cu 34 grams, Mn 45 grams, Zn 80 grams removed per hectare.
- Application rates of chelates are selected so as to replenish the soil with the essential growth nutrients actually removed in crops, leaves and stems. Therefore chelates are applied as necessary but indicatively, the requirements are 50-100 grams and sometimes up to 200 grams of the trace metal per hectare. This supply rate for trace metal is achieved by the indicative use of (in our case) 1- 2 litres of liquid chelate per hectare.
- For the sake of completeness, we advise that with a specific gravity of ~ 1.2, the application rate of our liquid chelate is of the order of 1.2 - 2.5 kg /ha and that the implied rate of application of the chelating agent, the substance of this petition, at 14% of the chelate contents, is 170 - 350 grams of ammonium glycinate per hectare. As a caution, we need to mention that ammonium glycinate is not present as such in a chelate and that the quantities discussed herein are for demonstration of the generally small quantities required for all of trace metals (‘micronutrients’), chelates and the component chelating agents, the latter being the substance of this Petition.
- The recommendation is to dilute our chelate with water at a dilution rate of 100 to 1, ie one litre of chelate makes 100 litres of liquid to be applied to the soil.
- The method of application of diluted chelate is flexible and it may be applied to a trench or furrow to suit row crops or it may be sprayed onto the soil to suit broad acre crops.

### **Item B5: Source and manufacturing process.**

The source and manufacturing process for liquid ammonium glycinate is simple and it is the same as for the formation of any salt from an acid and a base.

Specifically, an acid/base neutralisation reaction is set up where exact, pre-calculated quantities of ammonium hydroxide and the amino acid ‘glycine’ are introduced to a reaction vessel. The intention is to produce from these raw-material substances an “organic-chemistry salt”. The raw material substances for producing ammonium glycinate are selected so that the resulting salt has the power to act as a sequestration agent and as a precursor in the formation of a ‘metal-organo-complex’.

We have been guided to present a detailed description of the background and technical context of sequestration agents and we therefore add the following:-

#### **B5.1 Terminology of salts derived from acids.**

Salts are derived from acids.

Names given to salts are, by convention, taken from the name of the acid, for example:-

- hydrochloric acid produces ‘chloride’ salts
- sulfuric acid produces ‘sulfate’ salts
- lignosulfonic acid produce ‘lignosulfonate’ salts

- glycine produces 'glycinate' salts.

Conversely, the chemical name of the salt gives the name of the acid and alkali used to produce it.

### **B5.2. Properties of a salt exhibit none of the properties of the component raw materials.**

A substance referred to as a 'salt' exhibits none of the properties of its component raw materials.

This can be seen in the everyday substance we call 'table salt', sodium chloride. Once a salt has been formed, the process is, to all intents and purposes, irreversible.

Table salt as a substance exhibits none of the properties of the component sodium hydroxide or hydrochloric acid. These component substances need to be accurately known as to strength and purity, otherwise a predictable and reproducible reaction cannot be achieved. We clearly do not want unreacted traces of either hydrochloric acid or sodium hydroxide in our table salt.

It is the same with the salt called 'ammonium glycinate'; this substance results from the neutralisation of an amino acid 'glycine' with a base 'ammonium hydroxide'; it displays none of the properties of its component raw materials. The salt formation process is irreversible. Neither of these raw materials are produced from GMO processes.

Further, the substance 'ammonium glycinate' will not have contact with soil. This is because the substance is intended for use in the production of a 'double-salt' called a 'chelate'. In such a 'double salt', none of the properties of the raw materials - the sequestration agent and the elsewhere-approved micronutrient salts - are exhibited in the final product, the chelate. The chelate formation process is irreversible.

### **B5.3 Precedence for explicit approval in NOP for use of the raw material "ammonium hydroxide".**

Explicit approval is given in NOP clause 205.601 (e) (1) for the use of ammonium carbonate; in that clause, its use is as a bait in insect traps.

- Ammonium carbonate is a salt of ammonium hydroxide and carbonic acid.
- From this, we believe it is correct to claim the existence of a precedent in NOP for acceptance for non-nutrient and non-soil-contacting uses of ammonium hydroxide.

### **B5.4 Precedence for explicit recognition in NOP of "chelating agents".**

Explicit allowance is given in NOP clause 205.601 (j) (4) for the use of lignin sulfonate as a chelating agent. Since chelating agents produce chelates, it is clear that chelates, as a conceptual class of substances, are intended to be approved for use.

- The approved chelating agent 'lignin sulfonate' is a salt of ligno-sulfonic acid, an organic-chemistry acid.
- OMRI approves the use of **ammonium** lignosulfonate. This indicates that the alkali used was ammonium hydroxide; hence, ammonium hydroxide is explicitly approved to act as a "base" to form a salt with an organic-chemistry acid.

Approval of the ammonium salt of ligno-sulfonic acid in OMRI is the second precedent, after ammonium carbonate in NOP, for use of ammonium hydroxide for specific non-nutrient use and non-soil-contacting use in 'chelating agents', or sequestration agents.

In essence, this Petition is seeking explicit approval for the use of specific chelating-agent-substances based on a salt of ammonium hydroxide and an organic-chemistry acid 'glycine'.

### **B5.5 Necessity for the use of commercially pure substances to form salts.**

It is implicit in Western law that commercially traded substances and finished products be 'true-to-label'. For this reason, it is important that a manufacturer be able to control the composition of substances formed by chemical reaction, such as for example the formation of 'salts'. The manufacturer needs to have known and re-produceable composition raw materials to reliably reach the 'end-point' of neutralisation. It is only in this way that finished products are able to be sold 'true-to-label'. For this reason, 'commercially pure' raw material substances are required to be used for the production of chelating agents. We have called these commercially pure substances 'nature-identical'.

As the substance for our petition is the chelating agent, we provide a description of its manufacturing and processing procedures from its pure substance components as follows:-

- nature identical amino acid - "glycine"- (purchased on the open market in commercially pure form, 98%-99%) is neutralised in a calibrated manner (*stoichiometrically*) with nature identical ammonium hydroxide under controlled conditions to form ammonium glycinate. Ammonium glycinate is an organic-chemistry salt; this has the necessary property of being able to form at least 2 bonds to the central metal ion of a metal salt (*such as the salts of the 4 micronutrient metals*). The formation of at least 2 bonds to the central metal ion is a condition for the formation of a "chelate", as defined by the International Union of Pure and Applied Chemistry. (IUPAC). A glycinate salt forms its 2 bonds with the central metal ion by forming one bond with a deprotonated acid group  $-\text{[COO]}^{-1}$  and another bond with a deprotonated amino group  $-\text{[NH}_2\text{]}^{-1}$ . The role of ammonium hydroxide is to deprotonate ie to remove a positively charged proton  $-\text{[H]}^{+1}$  through the use of its negatively charged  $-\text{[OH]}^{-1}$ . The resulting negatively charged  $-\text{[COO]}^{-1}$  and  $-\text{[NH}_2\text{]}^{-1}$  are 'anions' and are able to form coordination bonds with the positively charged central metal ions (the 'cations'). We understand that NOP and OMRI already accept amino acids for the formation of chelates meaning that we are not proposing something which has not already been accepted. The chemical routes for production of commercially pure glycine are well known from text books: In short, glycine is able to be made by sequential substitution of one hydrogen molecule in fermented vinegar (acetic acid) firstly by a chlorine molecule and then by an amine molecule. We note that glycine is the smallest amino acid in the universe and that ammonium hydroxide is the smallest organic-chemistry alkali in the universe. Acetic acid can indeed be made by fermentation routes; the production of glycine from this 'natural' raw material has been found to be possible by substitution of one Hydrogen for one -NH<sub>2</sub> radical within vinegar, adopting a modern chemical process. The current actual production routes are often determined by local economies, especially nowadays in China from where the predominance of tonnage chemicals is sourced. We highlight the fact that the properties of glycine, when neutralised into a salt, are completely different to its properties as an amino acid and further that the properties of this transient salt are completely altered again when the chelating reactions have proceeded to completion. We have checked with an Australian supplier and have confirmed that manufacture of glycine by our supplier in China does not involve GMO sources.
- It would be perverse indeed if, intending to permit the production of chelates for organic-certified crop production, these smallest acid and base molecules in the universe, glycine and ammonium hydroxide, were to be administered as not acceptable in their role as sequestration or chelating agents.

**Item B6 : A summary of previous reviews of the petitioned substance.**

To the best of our knowledge, ammonium glycinate has not been reviewed as a chelating agent by any State or private certification programme or other organisation.

**Item B7: Information regarding EPA, FDA and State regulatory authority requirements.**

Ammonium glycinate:  
EPA Registry Service for ammonium glycinate : 254284  
Glycine mono-ammonium salt: 29728 - 27 - 6  
SID: 176276159

**Item B8: Chemical Abstracts Service (CAS) number and product labels.**

Sequestration agent / Chelating agent :

**Ammonium Glycinate.**

synonym: glycine mono-ammonium salt.  
CAS Number: 29728 -27 - 6.  
PubChem CID: 161644.  
Molecular weight: 92

The liquid form of this substance is immediately reacted in solution with one of 4 metal salts, without removing it from the reaction vessel or exposing humans to the liquid within the reaction vessel.

The concentration of ammonium glycinate is always very low (*never exceeding indicatively 14% of the total reaction mix in our process route for chelates*). In the unlikely event of contact of reaction vessel contents with human skin, there is a very low level of hazard, as the substance is at a low concentration, is not toxic and can be easily washed off with water.

The specific properties of pure ammonium glycinate no longer exist - and can no longer be expressed - once it has reacted with a metal salt to form an irreversible chelate complex inside the reaction vessel.

Label:

No label is available for liquid ammonium glycinate; we use this salt only as a consumable intermediate-substance in the process of formation of a micronutrient chelate; the latter is the substance offered for sale for use by an organic-certified crop producer.

**Item B9: The substance's physical properties and mode of action.**

(a) Chemical interactions with other substances. There is no chance of chemical interactions of ammonium glycinate with other substances once ammonium glycinate is 'locked-up' with a metal salt to form a chelate. The very word '*chelate*' derives from a Greek term meaning 'crab-like' or 'claw'; this is a reference to the tight bond formed between a chelating agent and the metal ion contained within a metal salt.

- (b) Toxicity and environmental persistence. There is no toxicity possible from ammonium glycinate once it has been 'locked-up' in a chelate molecule which itself is a source of beneficial nutrients to crops. We re-iterate that ammonium glycinate is not intended for application to soils; its use is only as a transient, intermediate reaction substance in the formation of a chelate. The degree of concern expressed by the National Institute of Environmental Health Science (NIEHS) about ammonium glycinate is demonstrated by the fact that they have not bothered to study it; ammonium glycinate is one of those products of 'minimal concern' (to use their own phrase). Ammonium glycinate does not have environmental persistence because of its complete absorption in plants and subsequent removal in crops when applied at its contained rate in chelates at (indicatively) 170-350 grams per hectare.
- (c) Effects on human health. There can be no possible effects on human health from the manufacture and use of ammonium glycinate when it is formed and used as a transient substance inside a reaction vessel from which nothing is allowed to escape.
- (d) Environmental impacts from its use and manufacture. There are no environmental impacts from the manufacture and use of ammonium glycinate when it is formed and used as a transient substance inside a reaction vessel from which nothing is allowed to escape.
- (e) Effects on soil organisms, crops and livestock. There can be no possible effects on soil organisms or crops or livestock from the petitioned substance because it is never employed anywhere near a farm in its pure form; it has no agricultural value or use in its pure form; it is employed, in our case, only in reacted form, having acted as a key substance in the formation of beneficial chelates for crops. Effects of the chelates themselves on crops are uniformly positive if indeed there is a deficiency in soil of one of the four trace metals contained in one of the four chelates. Soil organisms are not affected by the heavily diluted chelate nor are animals.

### **Item B10: Materials Safety Data Sheet (MSDS).**

There are no MSDS safety sheets for liquid ammonium glycinate as there is, to our knowledge, no trade in it, as a liquid.

The proposed use we foresee for ammonium glycinate is that of a transient reaction substance inside a reaction vessel during the manufacture of a finished product, namely a chelate for micronutrients.

MSDS sheets are available for finished-product chelates but not for the transient, intermediate substance ammonium glycinate.

### **National Institute of Environmental Health Science (NIEHS)**

An email from NIEHS dated 12 December 2015 states:

*"Please be advised that the National Toxicology Program (NTP) has not studied ammonium glycinate."*



## **Item B11: Research information on the chelating agent in this Petition.**

The substance included in our petition is an intermediate substance called a sequestration agent or chelating agent.

It is a specialist product prepared only by specialist manufacturers who intend to manufacture organic-certified products delivering copper, iron, manganese and zinc chelates to crops.

The liquid is called an 'intermediate' substance because it does not exist outside the reaction vessel in which a liquid chelate finished product will be formed from it. Upon chelate formation, the properties of the initial chelating-agent substance are no longer in evidence and the reaction is irreversible.

The chelating agent in liquid form is not an article of commerce, to our knowledge.

Research articles and reviews denying the effectiveness of amino acid chelating agents are not likely to be published in the face of successful chelation reactions achieved with their use.

Chelates using salts of glycine, while successful in delivering micronutrients in some soil conditions, are not capable of delivering micronutrients in soils beyond ~ pH 6.5 - 7.0; this is because these single chelates do not have a high stability constant and are readily decomposed in soils with pH > ~7. Decomposition of the chelate exposes the ionic form of micronutrient to precipitation reactions in soil. By comparison, the un-chelated form of the micronutrient ie the ionised metal salt, is continually exposed to precipitation reactions and it is practically useless in soils with a pH > ~5.3. So, the benefit of a glycinate chelate is to expand the range of soil pH in which micronutrients are able to be delivered to plants.

Research reports on the effectiveness of salts of glycine and salts of EDTA as chelating agents do exist. However, chelating agents based on salts of EDTA are not approved by OMRI.

Alternative chelating agents based on a salt of a citric acid are the subject of our Petition (1).

Research information on the combined use of two chelating agents on the one central metal atom has not been found in the literature.

## **Item B12: Petition Justification Statement.**

(1). We have been asked to explain why the synthetic substance in our Petition (2) is necessary for the production of an organic product. The reason is: that the petitioned substance is critically required in the production process for a 'chelate'; 'chelates' themselves play a vital role in that they 'deliver' essential plant nutrients to soils in an 'available' form in a wide range of soil conditions where substances currently allowed in NOP are not capable of doing so. Chelates can be considered as a 'value added product'.

(2). We have also been asked to describe whether any non-synthetic (ie 'natural') substances or alternative cultural methods could be used in place of our petitioned substances. The answer is provided in 2 stages:

- it is only through allowance in NOP clause 205.601 (j) (6) (ii) that the essential 'trace metals' of copper, iron, manganese and zinc are allowed in organic agriculture; the trace

metal forms permitted are synthetic; it follows that all chelates produced from such synthetic-substance starting points will also be synthetic ie there are no 'natural' chelates available ie they all have to be manufactured. 'Nature-identical' substances used in the formation of chelating agents are also classified as synthetic by NOP; hence no change in the synthetic classification of manufactured chelates is occasioned by their use. Heterogeneous composition organic-chemistry acids such as amino acids (the so-called 'natural forms') may be available from processes involving fermentation or hydrolysis but a manufacturer of chelates could not use such substances due to random variations in specie and composition.

- there is no known cultural method where the metal elements in trace metals are able to be 'created'; each trace metal must be provided individually as an external input; this is accepted by NOP because it has specifically included them in NOP clause 205.601.

(3). We have also been asked to describe the beneficial effects to the environment, to human health and to farm ecosystems from the use of the synthetic substance in our petition. We address each of these headings in detail in the numbered paragraphs which follow, but in brief:-

- the key benefit to the environment from the use of precision chelates is that farmers will be able to accurately limit nutrient quantities applied to the soil to that amount which will be taken up by the target crop in that season. At present, quantities of simple metal salts as already allowed in NOP are applied at a rate of 4-5 times of plant take-up; this is because it is known that the ionic forms of the micronutrient metal will be rapidly precipitated from metal salts when coming into contact with high pH soil. A lower application rate of chelated trace metals means less pollution of the environment caused by run-off of farm waters.
- the benefits to human health significantly depend on the local situation. For example, in developing countries, where there are decades-long deficiencies of iron and zinc in staple food grains, due to failure to replenish, the benefit to humans from having higher levels of iron and zinc in the grain-head will be the avoidance of the scourge of cretinism - a malady in children caused by deficiency of iron and zinc. The UN currently has 'bio-fortification' programs to introduce grain varieties which will help solve the nutritional problem, but we feel this is able to be immediately and effectively addressed by the use of properly formulated chelates. In developed countries, such as USA, Australia and Europe where there is a wider choice of foods, such deficiency-syndromes are not frequent and altogether less likely; nevertheless humans everywhere will benefit from the successful use of chelated micronutrients through better flavour, increased proteins, increased vitamin contents and increased yields. The very high 'cachet', especially in developing countries, of an "organic" label means that uptake of the use of organic-certified chelated micronutrients will be fostered and this will inherently accelerate the gain of potential advantages from their use in these countries.
- we confirm that the use of 100-200 grams per hectare of a chelated micronutrient will not have any adverse effect on the environment. In fact, the opposite case must be strongly stated:- **unless** relatively tiny quantities such as 100-200 grams per hectare of micronutrients are effectively delivered as replenishment in organic-certified crop production (and in all other forms of agriculture) there will exist the danger of an **adverse effect on the environment** through loss of crop yield leading to higher consumption of land, labour and energy per unit of crop output than would otherwise have been the case. This issue also addresses the concerns of lack of 'sustainability' if proper replenishment of nutrients is not practiced.

(4). We have also been asked to directly address "the third bullet point" in NOP's letter dated September 25, 2015, dealing with beneficial effects to the environment, human health and

farm ecosystem. We are happy to do so based on the 7 years experience we have gained by working with Australian organic-certification agencies and with OMRI in USA. Essentially, our Petition requests a substance to be admitted under “plant or soil amendments” in NOP clause 205.601: ‘*Synthetic substances allowed for use in organic crop production*’.

The situation is that NOP already allows (in clause, in 205.601.(j).(6).(ii)) synthetic forms of the micronutrient metals zinc, copper, iron and manganese; this is a vital inclusion, because, with it, NOP recognises that micronutrients are essential for healthy crop production. NOP recognises in another clause (in clause 205.601.(j).(4)) the existence and usefulness of ‘chelating agents’. This is another vital inclusion because with it NOP evidences knowledge of potential benefits to be gained from the use of ‘chelating agents’. In other words there is already a lot of common ground in terms of specific substances. NOP, OMRI and the Australian authorities already permit the use in organic-certified systems of:-

- amino-acids for chelate production via their salts.
- citric acid for pH adjustment.
- calcium citrate as a ‘sequestrant’
- ammonium carbonate as an insecticide
- ammonium lignosulfonate as a chelating agent.

These examples indicate that NOP and OMRI have already considered - and accepted - some of the very raw materials which are at the heart of our Petition. Because of this, it can readily be seen that our Petition for acceptance of ammonium glycinate as a chelating agent is not a radical one.

In essence, we are requesting approval to replace ‘*lignosulfonate*’ in ammonium lignosulfonate with ‘*glycinate*’. Similarly, our Petition can be seen as requesting approval to replace ‘*carbonate*’ in ammonium carbonate with ‘*glycinate*’. What we are pointing to is the existence of ‘families’ of chelating agents, wherein one approved chelating agent appears with equal standing with another using the same raw material substances. NOP is asked to recognise that the advance of scientific knowledge has created conditions where potential advantages can be gained for producers and consumers. Our Petition seeks to expand the circumstances where the benefits of glycinate salts, in particular, ammonium glycinate, might be expressed for the benefit of organic-certified crop production.

Note that the role of ammonium hydroxide in the chelating agent being petitioned is not to supply nutrient nitrogen (a role not accepted by NOP) but a role in which the —[OH] group within the hydroxide acts as an alkali to neutralise the hydrogen protons in the —[COOH] and —[NH<sub>2</sub>] groups within glycine.

(5). Chelates are “value added” substances which have the specifically sought-after properties of being able to ‘deliver’ essential plant nutrients to plants in soil conditions where existing approved substances (such as metal salts) cannot do so.

The manufacture of chelates requires the use of so-called chelating agents (also called ‘chelants’, ‘complexing agents’, ‘sequestrants’, ‘sequestration agents’, ‘binding materials’; for uniformity we suggest using the term ‘sequestration agents’ or ‘chelating agents’.

We have referred to allowances already existing in NOP’s clauses. Because of their existence :-

- we wish to utilise NOP’s explicitly-approved form of micronutrient metal salt, and
- we wish to further implement NOP’s explicitly-accepted concept of “chelating agent”.

But a problem of implementation arises at the next two levels of detail because:

- NOP has not yet explicitly identified **allowable** chelating agents to be connected with the explicitly-permitted trace metal salts, and, at a deep level of detail,

- NOP has not yet explicitly identified raw materials from which allowable chelating agents will be permitted to be formed.

(6). Put briefly, we form a chelating agent by using the simplest, smallest, nature-identical raw materials in the universe.

We note that even nature-identical raw materials might be classified as 'synthetic' substances by NOP; but since these nature-identical raw-materials are intended, exclusively, for reaction with metallic salts, themselves previously classified as synthetic, there would seem to be no difference in organic status for the finished chelate product through the use of nature-identical raw materials ie the finished chelate will always be 'synthetic' when the raw material metallic salts are synthetic

- The amino acid we use to form the salt which acts as a chelating agent is the simplest and smallest amino acid in the universe (*glycine*).
- The alkali we use to form a salt with glycine (*ammonium hydroxide*) is the smallest and simplest organic-chemistry alkali in the universe.

It would seem perverse if approval for use of these simple substances were to meet official disapproval in a situation where the necessity for chelating agents was already foreseen some 25 years ago and where reference to them as a class of compound has already been made by NOP, but where NOP has merely omitted development of detail for selection of ingredients for implementation.

(7). One benefit achieved by choosing the smallest molecules for acids and bases for chelating agents is that the deliberately chosen low molecular weight of these substances achieves the highest possible weight percentage in the final mixture; this is an economic benefit while still maintaining all desirable technical merits and "organic" status.

(8). Our Petition would not be complete if we omitted to stress the botanical fact that copper, iron, manganese and zinc are **essential nutrients** for healthy plant growth. There are no substitutes for any of these 4 trace metals; if a soil is deficient in (say) zinc, then only zinc is capable of remedying a zinc deficiency. There is simply no form of 'cultural method' that can replace the absence of zinc; zinc - and the other trace metals - are correctly considered as an external input which provide the specific micronutrient which may be either naturally deficient or completely absent or needed to be replenished because of removals in grains, stalks and leaves.

(9). Our Petition would be incomplete if we omitted to refer to the rules of inorganic-chemistry regarding 'solubility product' of metal salts and the facts of the effect of soil pH on charged metal ions. This whole topic is concerned with 'availability' of nutrients to plant roots.

- For a metal ion of +2 valency, such as ferrous iron, every increase of soil pH by one unit, decreases the availability of the ionic metal form by a factor of 10 squared ie by a factor of 100. For an increase of pH by two units, the availability of the ionic metal form of +2 valency decreases by a factor of the square of 10 squared ie by a factor of 10,000.
- For a metal ion of +3 valency, such as the ferric ion, every increase of soil pH by one unit, decreases the availability of the ionic metal form by a factor of 10 cubed ie by a factor of 1,000. For an increase of pH by two units, the availability of the ionic metal form of +3 decreases by a factor of the square of 10 cubed, ie by a factor of 1,000,000.

These quantitative facts identify the reasons for the occurrence of trace metal deficiencies, especially of iron in high pH soil, defined as any soil with  $\text{pH} > \sim 6.5$ .

(10). We stress that all farmers must know about and understand plant nutrients; that their knowledge must be in the right context; that data needs to be quantified; that each of time

(time of use), place (placement of nutrient), rate (rate of application) and source (source of nutrient) must be understood by farmers and that knowledge is both crop specific and site specific.

The manner in which NOP might help to drive home these important understandings has yet to be determined. But a good start would be for NOP to ensure that effective forms of plant nutrients are at least approved for use so that farmers might be able to acquire them for use, as and when necessary for specific crops in specific sites.

(11) We refer to the existence of terms such as microsurgery, microscope, microclimate, microorganism and micronutrient. These terms refer to the world of small things; each of the fields covered is a special case; each field requires special knowledge, new techniques, special treatment - and careful understanding - micronutrients included.

The need for careful understanding of micronutrients explains the invention of chelates for agriculture; it was found that chelates have a special protective-property which prevents aggressive soil conditions from 'locking up' or precipitating essential plant nutrients ; definition of these essential plant nutrients became part of modern science; NOP is now in a strong position to permit implementation of new findings from modern science by allowance of chelates for micronutrients using specific substances such as ammonium glycinate as chelating agents.

(12) It would seem helpful to include an understanding from modern science about the formation of chelate bonds. An organo-metal complex, a "chelate", requires, by definition, the formation of at least 2 bonds with a central metal ion; this is an international chemical convention such as documented by IUPAC. One of the two required bonds from the glycine salt is readily formed from its  $-\text{[NH}_2\text{]}$  group and the other is from its  $-\text{[COOH]}$  group once the [H] proton within each is neutralised by the [OH] group from a base (alkali). The negatively charged radicals  $-\text{[COO]}^{-1}$  and  $-\text{[NH}_2\text{]}^{-1}$  are able to bond with the positively charged central metal ion forming very stable 3-dimensional bonds. Note that:

- the negative radicals  $-\text{[COO]}^{-1}$  and  $-\text{[NH}_2\text{]}^{-1}$  are **not** formed if the  $-\text{[COOH]}$  and  $-\text{[NH}_2\text{]}$  groups are not neutralised and that
- chelate bonding cannot proceed without neutralisation.
- OMRI does not exhibit an understanding of this; because of this OMRI has omitted all mention of the need for an alkali when discussing chelate manufacture. This omission has passed into Australian Organic Standards greatly hindering a correct interpretation of what is, and what is not, the correct manufacturing route for a chelate. This is the origin for our Petition in that we seek explicit approval of substances which are known to be essential (but as yet given only implicit approval by NOP).

(13) We refer to email-discussions with OMRI during May-July 2010. OMRI take the view that it is not part of their role to 'opine' on the need for, or efficacy of, substances approved for organic crop production; they will administer the documents as documented. A review by one of their Technical Committees is available, upon request, but a time scale of approximately 2 years was advised as the norm for considering a revision.

(14) The Australian organic-certification agencies take a similar view to OMRI. They have now agreed that the Australian Organic-Standard, based on OMRI, is "*not complete at all points*"; this is a reference to the erroneous omission of an alkali in the manufacture of a chelating agent. However, they do not see it as part of their role to amend the Australian Standard; they feel that their role is merely to administer the Standard as documented and to audit compliance to it by third party Applicants (whether the Standard is complete or accurate, or not).

(15) In the situation outlined, NOP has available an initiative whereby new, explicit allowances and approvals can be introduced into NOP's documents (as herein petitioned)

so that 'downstream' agencies such as OMRI and Australian certifiers have an unmistakably clear authority to make better informed decisions regarding organic-certification.

(16). The electronic Code of Federal Regulations (e-CFR dated 30 October 2015) shows *"Title 7: Agriculture: Administrative"*.

We stress that our petition is tailored to the specific needs of agriculture; we feel we have followed the spirit of NOP; and we feel that our synthetic-substance chelating agent and the resulting chelates are "fit-for-purpose" of organic-certified-agriculture.

**Item B13. Confidential Business Information Statement.**

Simple, nature-identical, readily available, safe, low cost industrial substances can be combined firstly with each other in a calibrated manner and then subsequently combined with NOP-permitted synthetic micronutrient substances to form a new, useful substance termed a "micronutrient chelate".