United States Department of Agriculture
Agricultural Marketing Service | National Organic Program
Document Cover Sheet
https://www.ams.usda.gov/rules-regulations/organic/national-list/petitioned

Document Type:

☒ **National List Petition or Petition Update**

A petition is a request to amend the USDA National Organic Program's National List of Allowed and Prohibited Substances (National List).

Any person may submit a petition to have a substance evaluated by the National Organic Standards Board (7 CFR 205.607(a)).

Guidelines for submitting a petition are available in the NOP Handbook as NOP 3011, National List Petition Guidelines.

Petitions are posted for the public on the NOP website for Petitioned Substances.

☐ **Technical Report**

A technical report is developed in response to a petition to amend the National List. Reports are also developed to assist in the review of substances that are already on the National List.

Technical reports are completed by third-party contractors and are available to the public on the NOP website for Petitioned Substances.

Contractor names and dates completed are available in the report.

NATIONAL ORGANIC STANDARDS BOARD

Addendum 1

to

A Petition to add chelating agents to the National List.

Ammonium citrate

Ammonium glycinate

Date of this Addendum to the original Petition:
20 June 2018

Petitioner:
Robert Phillip.
Sydney, Australia

Manufacturer:
Alpha Chemicals Pty Ltd.
Sydney. Australia.

Background:-

A Petition dated September 2015, accepted by NOP as complete in March 2016, sought acceptance of ammonium citrate and ammonium glycinate as chelating agents for use in organic-certified crop production; this was denied in September 2016.

The Petitioner has in June 2017 lodged appeal documents accepted by NOP as complete in November 2017; NOP forwarded these documents to NOSB who, in November 2017, commissioned a third party Technical Report as follows:-

- what is a chelating agent?
- what is a chelate?
- what is a metal salt?

This present document, forwarded as a formal Addendum 1 to the Petition accepted in November 2017, provides additional technical information to guide decision making by NOSB and NOP. The data herein will overlap and reinforce, to some degree, some of the data expected to be contained in the third party Technical Report.

A Table containing an overview of relevant chemical concepts:

An organic-Chemistry **Acid**	**Ligand** **- 'chelating agent".** - a salt of an organic chemistry acid	**Chelate** - a 'double salt' containing both a ligand and an **<u>un</u>**-chelated metal salt
Citric acid	Ammonium Citrate	[Ammonium citrate | Zinc sulphate] chelate
Glycine	Ammonium glycinate	[Ammonium glycinate |Zinc sulphate} chelate
<u>Comment:</u> Acids are converted into salts by means of bases ('alkalis'). This is called 'neutralisation'.	***<u>Comment:</u>*** Ligands are **'scavengers'** of trace metals copper, iron, manganese and zinc. Another term for a ligand is "chelating agent".	*<u>Comment:</u>* Chelates are **providers** of trace metals copper iron, manganese and zinc. Another term for a chelate is "organo-metal complex".

The above Table demonstrates the classification of chemical substances into discrete "acid", "ligand", and "chelate" categories. Each of these categories has a specific, non-overlapping function in the formation of chelates for organic-certified crop production.

What follows from the Table is this:-

1. An acid cannot act as a ligand /chelating agent.
   - If ***citric acid*** could act as a chelating agent, then freshly squeezed orange juice ingested by humans would scavenge iron from our blood.
   - NOP and NOSB are in error in believing that acids can act as chelating agents.
   - Acids must first be neutralised into salts before a chelating agent is formed.
   - NOP and NOSB are in error when they omit all reference to alkalis for neutralisation of acids in the formation of chelating-agent-salts.

2. A ligand cannot act as a chelate.
   - A ligand combines with or 'scavenges' trace metals. For example, it is possible to reduce excess iron in human blood by ingesting chelating agents; these can combine with iron and copper and thus allow controlled reductions of excess trace metals.
   - NOP and NOSB are in error in believing that chelating agents have a role as soil amendments to correct trace metal deficiencies; Chelating agents themselves contain no trace metal and therefore cannot correct soil deficiencies of trace metals.
   - Ligands are not added to soil on a farm; they are combined in a factory with an **un**-chelated metal salt (already approved by NOP) and only then is the new compound - a "chelate"- added to the soil.

3. A chelate is used in agriculture to correct micronutrient deficiencies in soil.
   - Chelates are especially suited to overcome micronutrient deficiencies in high pH or alkaline soil; it is chelates which contain the trace metal, and not the chelating agents.

- For example, ingestion of iron chelates by humans is effective in increasing iron in the blood when there is a known iron deficiency ie chelates are providers of essential ingredients whereas chelating agents are scavengers of ingredients present in excess.
- In terms of their mode of operation: chelates have a very powerful bond between the ligand and the trace-metal-salt; the trace metal is thereby 'protected' from adverse reactions such a precipitation in high pH soil solutions; precipitation in soil solutions causes the ionic-trace-metal to become 'unavailable' (useless) to the plant.
- NOP and NOSB make no mention of chelates for copper, iron, manganese or zinc in Document 5034-1; this needs to be corrected.
- It is not possible for a natural chelate to be formed from the raw materials synthetic acid, synthetic base and a synthetic metal salt; it is preferable to refer to a 'manufactured' chelate for agriculture.
- Manufacture of chelates requires the raw materials to be known as to specie and concentration and therefore the use of nature-identical raw materials needs to be sanctioned, in the specific instance of chelate manufacture.

4. Inspiration will not be gained by recitation of what is flawed…and the National Organic Program [NOP] as well as the Organic Materials Review Institute [OMRI] in USA have an understanding of chelates which is flawed

- NOP's Document 5034-1, NOP's National List of accepted synthetic substances and OMRI's definition of "chelate" provide documented evidence for the correctness of this statement.
- The Technical Report on chelates, commissioned by NOSB in November 2017 will provide a lot of the necessary background to justify revision of organic-certification documents in the field of chelates for agriculture.

WHICH CHELATES CAN BE MADE from the raw materials?

A good perspective of one route for chelate manufacture is able to be gained from the following Table. It shows that one organic-chemistry acid is able to make:

- 4 different chelating-agent-salts or 'ligands' and, furthermore, that:-

- each of ligands is able to make 4 trace-metal chelates, resulting in 16 chelates from one source-acid:

ACID	4 CHELATING-AGENT-SALTS (ligands).	METAL SALT of the micronutrient	16 micronutrient chelates using citrate.
Citric acid	Ammonium citrate using ammonium hydroxide	copper iron manganese zinc	[ammonium citrate]-[copper] chelate [ammonium citrate]-[iron] chelate [ammonium citrate]-[manganese] chelate [ammonium citrate]-[zinc] chelate
	Sodium citrate using sodium hydroxide	copper iron manganese zinc	[sodium citrate]-[copper] chelate [sodium citrate]-[iron] chelate [sodium citrate]-[manganese] chelate [sodium citrate]-[zinc] chelate

	Potassium citrate using potassium hydroxide	copper iron manganese zinc	[potassium citrate]-[copper] chelate [potassium citrate]-[iron] chelate [potassium citrate]-manganese] chelate [potassium citrate]-[zinc] chelate
	Calcium citrate using calcium hydroxide	copper iron manganese zinc	[calcium citrate]-[copper] chelate [calcium citrate]-[iron] chelate [calcium citrate]-[manganese] chelate [calcium citrate]-[zinc] chelate

A similar Table has been prepared for the source acid "glycine" resulting in 16 glycin**ate** chelates as follows:-

ACID	4 CHELATING-AGENT-SALTS (ligands)	METAL SALT of the micronutrient	16 micronutrient chelates using glycinate
Amino acid 'glycine'	Ammonium glycinate using ammonium hydroxide	copper iron manganese zinc	[ammonium glycinate]-[copper] chelate [ammonium glycinate]-[iron] chelate [ammonium glycinate]-[manganese] chelate [ammonium glycinate]-[zinc] chelate
	Sodium glycinate using sodium hydroxide	copper iron manganese zinc	[sodium glycinate]-[copper] chelate [sodium glycinate]-[iron] chelate [sodium glycinate]-[manganese] chelate [sodium glycinate]-[zinc] chelate
	Potassium glycinate using potassium hydroxide	copper iron manganese zinc	[potassium glycinate]-[copper] chelate [potassium glycinate]-[iron] chelate [potassium glycinate]-manganese] chelate [potassium glycinate]-[zinc] chelate
	Calcium glycinate using calcium hydroxide	copper iron manganese zinc	[calcium glycinate]-[copper] chelate [calcium glycinate]-[iron] chelate [calcium glycinate]-[manganese] chelate [calcium glycinate]-[zinc] chelate

THE WAY AHEAD.

1. Accept that NOP's documents make allowance for technical necessity.
   - If use of a synthetic substance is unavoidable for technical reasons, then NOP will, in the circumstances, accept use of that synthetic substance for organic-certified crop production.
   - The case of chelate manufacture contains such a technical necessity, where synthetic acids, synthetic bases and synthetic metal salts are unavoidably required.
   - There is no question in all this that GM materials will be required to be used.

2. Accept that NOP's source documents contain a specification that staff allocated to administer technical evaluations must have technical experience suited to the assessment task at hand.

- It can be said that the originators of the current wording in NOP's documents (now 10 years old) did not exhibit, in the instance of chelate manufacture, the requisite technical qualifications.

3. Accept that the term 'ligand' should replace, in the Standards and NOP's documents, each of the following equivalent terms: *chelant, chelating agent, sequestration agent, coordination agent, complexing agent, combining agent, chelator.*

4. Accept that it is a citrate salt of citric acid, and not citric acid itself, that acts as the ligand.

- Similarly, it is the glycinate salt of the amino acid glycine, and not glycine itself, which acts as the ligand.
- A revision of the wording under 'chelating agent' in NOP's documents is required to reflect the truth of the technical situation.
- Salts of acids (the 'ligands') are synthetic but are able to be considered as admissible in NOP's documents under the grounds of technical necessity.
- Furthermore, the reaction between ligands and micronutrient metal salts to produce a micronutrient chelate is able to be considered as admissible under the same grounds of technical necessity, in this instance.

5. Accept that an alkali is technically necessary to neutralise an acid to form a salt.

- Omission of a base ('alkali') is at the heart of the current misunderstanding about chelate formation and raw material specifications.
- Once an alkali is considered as un-necessary (in a Standard), then the way is clear for authors to wrongly require use (in the Standard) of the raw or un-neutralised acids *on their own* to act as ligands; this requirement cannot be supported because of the wrongful omission of an alkali.
- Acceptance of the true situation will reveal that use of nature-identical acids and bases is supportable in the specific circumstances of chelate manufacture.
- An explicit statement is needed to be included in NOP's documents about which alkalis will be accepted under NOP's authority.

6. Accept that the use of nature-identical acids and bases is technically necessary in the specific circumstances of chelate manufacture.

7. Accept that an expansion of Document 5034-1 is required so as to include "chelate" as an approved material for each of the micronutrients copper, iron, manganese and zinc.

CONCLUSION:

One example of a suitably rigorous technical addendum into NOP's documents concerning chelates is as follows:-

> *"Chelates are allowed using ligands such as the ammonium, sodium, potassium and calcium salts of polycarboxylic acids, including but not limited to citric acid and the ammonium, sodium, potassium and calcium salts of amino acids, including but not limited to glycine."*