ALBION®
HUMAN NUTRITION

Research Notes

A Compilation of Vital Research Updates on Human Nutrition

April, 2007 Volume 16, No. 1

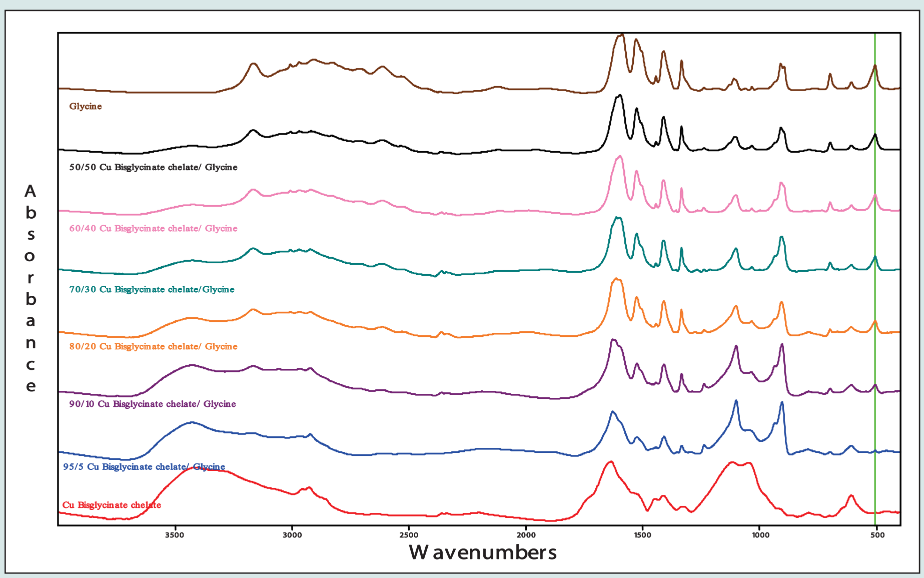
TRAACS™ Maybe the Biggest News in Mineral Amino Acid Chelate History

This year, Albion Advanced Nutrition has announced an exciting new chelate system, along with it has come a new trade name, TRAACS™. TRAACS™ is the trade name for Albion Advanced Nutrition's mineral amino acid chelate that goes along with its patented method for testing, which is detailed in the Research Notes. TRAACS™ stands for the The Real Amino Acid Chelate System.

Over the years, the industry has come to look to Albion Advanced Nutrition for things that related to mineral amino acid chelate technology: mineral amino acid chelate manufacturing, R&D, clinical research, patents (use, process and composition), and laboratory testing. The number of patents and published clinical studies related to Albion mineral amino chelates are each well into the hundreds. No other chelate producer can make this claim. In fact, no other mineral amino acid chelate producer has validated their product, and they have never published a clinical study on the "chelates". Recently, Albion Advanced Nutrition has made some breakthrough technological advances in the validation technique for the identification and the measure of the degree of chelation of a mineral amino acid chelate. Prior to this recent breakthrough, the testing for these required several tests, and needed much more time. This new testing method has been put through AOAC's single laboratory validation, and it has been presented at the AOAC's annual meeting. This method uses fast-fourier transforming infrared spectroscopy (FT-IR). In short, FT-IR measures the amount of infrared light that a compound absorbs at different wave lengths. Different bonds in a compound will absorb infrared light at different wave lengths of this light. A mineral amino acid chelate is composed of an amino acid that has two or more donor groups combined with the mineral so that one or more rings are formed, with the mineral being the closing component of this heterocyclic ring. Chelate structures contain covalent bonds, which give these chelates properties that are much different than ionically bonded mineral salt forms. Mineral amino acid chelates are bidentate (the mineral is attached at two ends of amino acid ligand), and have ring in their structure, while mineral complexes are unidentate (mineral is attached at one end of its ligand) with no ring structure. It has been shown that a bidentate (chelated) glycino group absorbs at the IR wavelength of 1643 cm-1, an ionized unidentate at 1610 cm-1, and a unionized unidentate at 1710 cm-1. In addition, it has been shown that the carboxyl group in the amino acid glycine absorbs at the band of infra-red light of 504 cm-1. The degree of absorption at this band segment has been shown to diminish as the amount of bound glycine increases in a sample. This is demonstrated on the next page in Figure 1. In this figure, it can be seen that as the absorbance at 504 cm-1 goes down; the ratio of bound copper bisglycinate to free glycine goes up.

As can be seen in the Table below, there are other band segments of the IR spectra that can be used in the identification of bisglycinate amino acid chelates. The band segments of greatest interest for the identification of a mineral amino acid chelate are the one's that relate to the

Figure 1.
FT-IR representation of diminishing 504 cm-1 peak in a chelated sample



bonds from the mineral to the amino and carboxyl portions of the amino acid. The table below tells the differences found in the spectra of glycine and identified zinc bisglycinate chelate.

The differences in the spectra of absorption between the glycine and the zinc bisglycinate chelate indicate the bonding to the mineral in the chelate structure at the amino (NH) and the carboxyl (COOH) ends. As listed in the above table and shown in Figure 2 (representing the entire IR spectra for a zinc bisglycinate chelate), the peak absorption for the zinc bisglycinate chelate at 1643 cm-1 is the evidence for the ring formation seen in a true mineral amino acid chelate.

Summary

Albion Advanced Nutrition® has demonstrated that the peak level seen in the infrared spectra at 504 cm-1 is specific to the amount of unbound ligand (glycine).

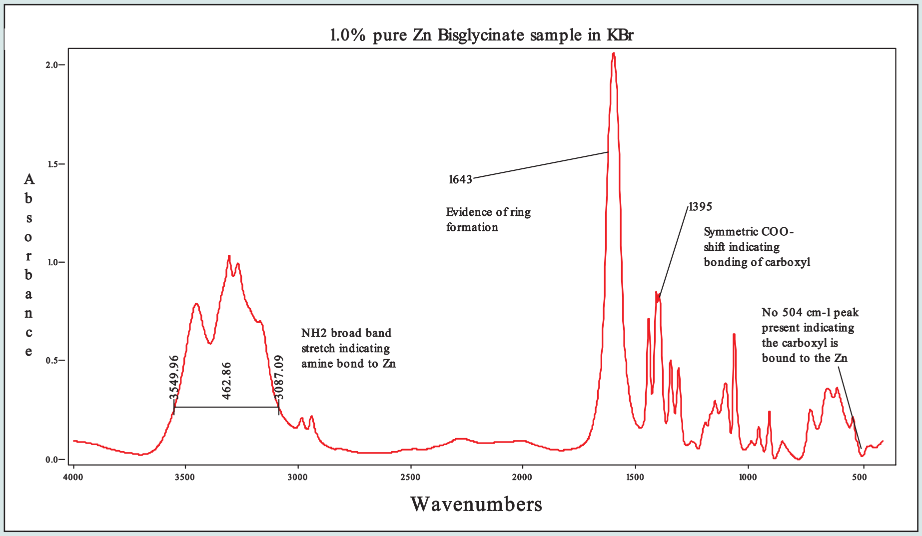
To determine the degree of chelation in a mineral amino acid chelate sample, Albion Advanced Nutrition® has combined these steps:

1. Identifies the mineral amino acid chelates via FT-IR profile.
2. Determines mineral content via testing (ICP).
3. Knows the total glycine content of
4. sample (from formulation data).
5. Using FT-IR studies determine amount of unbound ligand.
6. Calculate from these data the degree of chelation.

Table 1.

Glycine		Zinc Bisglycinate Crystals	
Wavenumbers cm^{-1}	Assignment	Wavenumbers cm^{-1}	Assignment
3050 – 2675	NH3* broad bands	3550 – 3050	NH2 broad bands
1410	Symmetric COO$^-$ Stretch	1395	Symmetric COO$^-$ Stretch
504	COO$^-$ rock	1643	Evidence of ring formation

Figure 2.
Entire IR spectra for zinc bisglycinate chelate



The Patented TRAACS™ Test

The testing method that Albion Advanced Nutrition's technical staff has developed for TRAACS™ has been issued a US patent (#7,144,737, Process for determining percent chelation in a dry mixture). However, we will not use this patent to prevent anyone from using this breakthrough method. Albion would like this method to become commonplace in the Industry. Our key technical personnel will be able to provide guidance in using this new testing technique, as well.

Albion Advanced Nutrition has been using this testing method to validate its mineral amino acid chelates. With the introduction of TRAACS™, Albion will also be introducing an advanced certificate of analysis (COA) to further underscore the validity of the Albion produced mineral amino acid chelates (TRAACS™). This advanced COA will be introduced sometime this year, and it will feature the FT-IR tracing for the TRAAC™ ingredient that our Quality Control department has tested and released through this COA. This will give our customers a valid method for the identification of the TRAAC™ in question. Albion Advanced Nutrition will be the only chelate manufacturer that is providing identification and identification methods for its chelates.

It is our hope that over time dietary supplement, pharmaceutical, and food companies will begin to use this test, as a matter of routine, when doing their QC on incoming mineral amino acid chelate materials. By doing so, these companies will be certain that they are supplying their customers with a validated mineral amino acid chelate, and the consumer can buy from them with confidence that they are getting what they paid for.

Testing Mineral Amino Acid Chelates

Albion Advanced Nutrition has often been approached by our customers to test mineral amino chelates that have been produced by other mineral suppliers. In truth, we have not found any of our competition that has produced a mineral amino acid chelate that meets the definition of a reacted mineral amino acid chelate, as defined by the NNFA (see in table 2).

With the advent of this new TRAACS™ test method, Albion has used this test on some of the competitions' chelates, along with some additional tests that we know give further evidence of an ingredient being a reacted mineral amino acid chelate. In Figure 3, the TRAACS™ test was applied to Albion's Ferrochel® (ferrous bisglycinate chelate) and a sample of another manufacturer's equivalent iron amino acid chelate. As demonstrated in the TRAACS™ test results in this figure, it is evident that the competition's chelate is not a chelate, and thus not equivalent to Albion's Ferrochel®.

To further demonstrate the difference between Albion's Ferrochel® and the other company's iron amino acid chelate, Albion did additional tests related to the parameters of a true mineral amino acid chelate. Figure 4 gives a summary of these test findings.

As stated in Figure 4, the ligand:metal ratio (L:M ratios) for Ferrochel® is 2:1, while Company F's iron amino acid chelate has an L:M of 0.7:1. This is a very critical point. A mineral amino acid chelate can exist at a molar ratio (L:M) of from 1: 1 to 3: 1, and the preference for minerals of +2 valence is a 2:1 molar ratio, which gives a +2 mineral the optimum chemical attributes to provide the highest level of mineral amino acid chelate advantages. In a case where the mineral is a +3 valence, the optimum molar ratio is 3: 1.

Company F's 0.7:1 molar ratio tells us that there is 0.7 moles of the amino acid ligand for every 1.0 moles of the mineral iron. This would mean that we do not have a true mineral amino acid chelate. To further show that Company F's product is not a mineral amino acid chelate, the ingredients were put into water, and then passed through a filter. In the case of Albion's Ferrochel®, the L:M ratio of the filtrate and the precipitate gathered in the filter was the same, which tells you that none of the iron separated from the ligand, which is an attribute of a mineral amino acid chelate. In the case of company F, the molar ratios of the iron and the ligand, which were already too low to be a chelate, were different for the filtrate and the precipitate. In addition, ferrous sulfate crystals were recovered from the liquid. Conclusion, Company F's iron amino acid chelate is not a chelate, and it is not to be considered an equivalent to Albion's Ferrochel.

Table 2.

REACTED MINERAL AMINO ACID CHELATE DEFINITION:

"Metal Amino Acid Chelate is the product resulting from the reaction of a metal ion from a soluble metal salt with amino acids with a mole ratio of one mole of metal to one to three (preferably two) moles of amino acids to form coordinate covalent bonds. The average molecular weight of the hydrolyzed amino acids must be about 150 AMU (Atomic Mass Units) and the resulting chelate must not exceed 800 AMU. The minimum elemental metal content must be declared. It will be declared as a METAL amino acid chelate; e.g. Copper Amino Acid Chelate".

Adopted by the NNFA Board of Directors July 1996

Figure 3.

FT-IR Spectral Comparison of Ferrochel® and Company F's Iron Amino Acid Chelate 20%

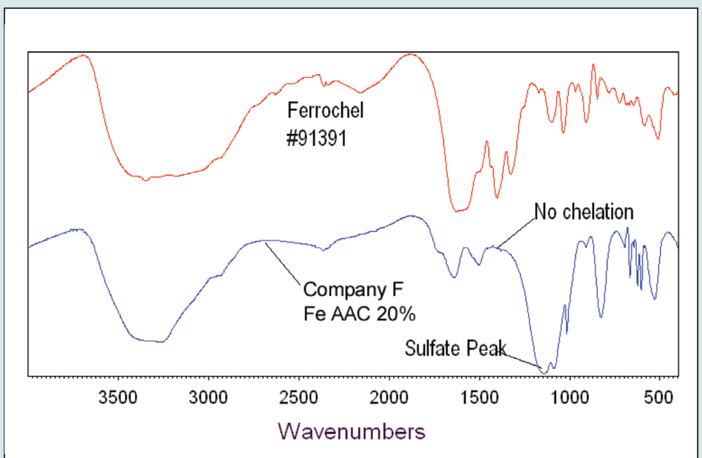


Figure 4.

Chemical Comparison of Feroche® and Company F's Iron Arino Acid Chelate	
Ferrochel®	**Company F's Iron AAC**
• L:M ratio is 2:1	• L:M ratio is 0.7:1
• No evidence of inorganic iron	• Evidence of ferrous sulfate present
• No other metal contaminations	• Showed evidence of K contamination
• No separation of metal from ligand in water	• Fe sulfate cyrstals were recovered ina water separation phase and metal separated from ligand

Conclusion

The new TRAACS™ Test can be one of the biggest breakthroughs in the mineral amino acid chelate field of technology. It will allow the producers of real amino acid chelates to be separated from the adulterated product that has been sold as their equivalents for many years. Albion Advanced Nutrition stands ready to back its mineral amino acid chelates (TRAACS™) with the proven method for validating its chelates.

For a complete listing of all of the Albion Advanced Nutrition TRAACS™ minerals contact Albion at (800) 222-0733. Or visit our website at www.AlbionMinerals.com.

No one can follow in Albion's

TRAACS™

Albion Human Nutrition
100 Maple Park Blvd., Suite 110
St. Clair Shores, Michigan 48081 USA
[P] 586•774•9055 | [TF] 800•222•0733
[F] 586•774•8838
[e] info@AlbionMinerals.com