



<u>Met</u>AMINO[®]

Evonik. Power to create.

A fresh perspective on our masterpieces

Although it says Evonik on the outside, inside it's still the same: reliable quality backed by decades of experience and continuous innovation of our products and services. At Evonik, our focus is on maximizing the nutritional value of our feed additives by putting the essential building blocks of protein better to work for you. It naturally translates into improved quality, less waste and smoother processes.

We believe that with competence comes responsibility – to you and your bottom line. That's why you get more than improved nutritional value, you get the added value of decades of expertise that makes your processes more efficient, your quality more consistent, and your operation more environmentally sustainable. We understand that your reputation is built on reliability, too. That is why ensuring consistency and reliability in both the quality and the supply of our products is at the center of the way we do things at Evonik. It comes from a longstanding tradition of delivering on a promise.



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Put the nutritional facts on your side

Performance, effectiveness, efficiency – these are common words used by scientists, nutritionists and producers when discussing animal nutrition. In the poultry and swine business, performance is defined by getting the most return from your animals. Achieving the highest productivity with the least amount of cost is the key issue. You will only reach this goal, if you are selecting your methionine source correctly.

In an industry that relies so heavily on raw materials, inconsistencies are unavoidable. Everything you put into your feed formulation affects your bottom line. Since all feed sources vary in their amino acid content, adding supplemental methionine requires precision. Using MetAMINO[®] from Evonik ensures that a precise product is dosed through a precise process.

Take a close look at the following information. It will help you familiarizing with MetAMINO[®]. You'll notice that we focus on the effectiveness of MetAMINO[®] compared to liquid MHA-FA. You'll also notice all statements are backed with thorough and objective scientific experiments as well as field trials.

Facts are facts. MetAMINO[®] can help your operation get ahead.



The essence of MetAMINO[®] is its nutritional strength

A powerful methionine source

Methionine is one of the most important amino acids in livestock nutrition. In poultry diets, it is even the first limiting amino acid. A deficiency in methionine is the first roadblock to growth (figure 1). A difference in biological efficacy between methionine sources can lead to a difference in performance parameters such as weight gain, feed conversion rate and breast meat yield.

Unlike MetAMINO^{*}, liquid MHA-FA is neither an amino acid nor a chemically pure product. It is actually a blend of monomers, dimers, polymers and water (figure 2). Although the chemical purity of liquid MHA-FA is about 88%, the bioefficacy figure applied in practical feed formulations still needs to be considered. A most recent literature evaluation conducted by Evonik (Lemme and Petri, 2003, AMINONews[®], Vol. 4, No. 3) carefully re-analysed existing scientific data. The results of this analysis showed a biological effectiveness below 65% for liquid MHA-FA in broilers on a weight to weight basis. For this species, there is a large body of data available in this data compilation. In contrast, the number of scientific data for layers, pigs and turkeys is more limited and requires further research. However, several scientific and many field trials in these species have shown no difference in animal performance when liquid MHA-FA was replaced with MetAMINO[®] at a ratio of 100:65.



The average bioefficacy from 138 dose response data sets is about 65% Result of a data review based on more than 70 scientific dose response trials in broilers, layers, turkeys and pigs as compiled from various publications (Lemme and Petri, 2003). Average bioefficacy values differed between species

and between performance criteria within species.

A powerful methionine sour

MetAMINO[®] is a white, crystalline product manufactured at a level of purity exceeding 99%. It's freeflowing with a high bulk density. These factors distinguish it physically from liquid analog forms of methionine such as liquid MHA-FA.

MetAMINO[®] is the most commonly used methionine source in poultry and swine nutrition. It can be added to premixes, mineral and compound feeds. Its technical properties guarantee homogeneous mixability and stability against demixing.



Figure 1. Limiting Amino Acids in Poultry Nutrition

"The Liebig Barrel" – protein synthesis, represented by the water in the barrel, occurs only to the level of the least abundant amino acid. In poultry this is methionine.



Figure 2. Methionine Sources



Get the nutritional balance with MetAMINO[®]

Higher bioefficacy – better dose response

Bioefficacy is a relative value that compares the nutritional efficacy of a given nutrient with a defined standard. It is most commonly measured in terms of weight gain, feed conversion and percent of breast meat yield for poultry. In swine, it is usually measured in weight gain, feed conversion and body protein retention with protein retention being the more sensitive parameter. Regardless of the animal, the important question is: How do the animals respond to the dosage? This question on the bioefficacy of MetAMINO[®] versus liquid MHA-FA has been intensively discussed in the industry. Fortunately, an impressive number of scientific studies, which are available today, have brought much more clarity to the subject. Figure 3 (dose response curves) illustrates the principles of a sound dose response study.

Both methionine sources showed considerable improvement over the control group. Notice that the relationship between the percent of breast meat yield and the amount of supplemented methionine was non-linear for both MetAMINO[®] and liquid MHA-FA. Also notice that liquid MHA-FA remained only 65 % as effective as MetAMINO[®] regardless of the amount of supplementation. This type of regression analysis reliably states that the relative effectiveness between the two is constant. Comparable experiments in swine resulted in a similar outcome. Yielding the greatest production with the least amount of cost – it's what every poultry and swine operation strives to do. MetAMINO[®] allows you to strike a perfect balance of the two. To prove that, we must start with an examination of biological effectiveness. Although scientific dose response trials formed the basis of evaluating the bioefficacy, the estimated figures needed to be challenged under practical conditions. To put science into practice, a lot of field trials were conducted, replacing liquid MHA-FA with 65% of MetAMINO[®] both in poultry and swine. On average, no significant differences in performance could be observed at the 65% exchange ratio tested. Figure 4 breaks these findings down according to animal species. As you can see, on average, 65 units of MetAMINO[®] were at least equal to 100 units of liquid MHA-FA in both, poultry and swine.

Turn sense into money

Why is bioefficacy so important? If liquid MHA-FA was priced relative to MetAMINO[®] according to its efficiency, then it wouldn't be. Cost effectiveness would be comparable in each. But in the market, liquid MHA-FA is often priced higher. By using liquid MHA-FA at a higher price ratio than

65% compared to MetAMINO[®], you might waste thousands of dollars a month (figure 5).



65 units DL-Methionine 📃 100 units Liquid MHA-FA

MetAMINO[°] vs. liquid MHA-FA

Relative performance for weight gain in poultry and swine when replacing liquid MHA-FA with MetAMINO[®] in a 100:65 ratio. Averages of original trial results from more than 100 modern performance tests, conducted at customer or University facilities.

Figure 3. Feed Conversion Ratio with different methionine sources



Source: Chinese Academy of Agricultural Science, China; Xiao et al. 2007

Figure 5. Cost Comparison – Broiler Diets



* Potential cost savings at different bioefficacy perceptions compared with a bioefficacy of 65% as recommended by Evonik.

MetAMINO° vs. liquid MHA-FA

Using liquid MHA-FA as a source to cover an annual methionine demand of 1000 metric tons. Assumed MetAMINO^{\circ} price/kg = \$4.00 US. Evonik recommendation based on data evaluation from more than 70 scientific dose response trials in broilers, layers, turkeys and pigs as compiled from various publications (Lemme and Petri, 2003, AMINONews^{\circ}, Vol. 4, No. 3).

A perfect process creates quality nutrition

Evonik is the leading supplier of supplemental DL-Methionine for the feed industry. MetAMINO^{*} from Evonik is used in over 100 different countries on 5 continents. High quality manufacturing processes enable us to offer a consistent quality product.

Its much higher activity than of liquid MHA-FA is the most important advantage of supplementing with MetAMINO[®], but it's certainly not the only one. Natural amino acid variability in raw materials makes the mixing and handling benefits of MetAMINO[®] crucial. You'll experience reduced mill maintenance, no viscosity problems due to low temperature and high mixing homogeneity. Less excretion – everyone wins

Especially in swine, the issue of nitrogen excretion as an environmental hazard has become one of growing concern. Nitrogen can pollute the water supply of neighbouring properties and cause production problems within an operation. Because MetAMINO[®] is utilized better than liquid MHA-FA, there is less surplus protein and thus less nitrogen excreted (figure 6).*

 \ast assuming liquid MHA-FA is formulated at higher than 65 % bioefficacy

A gentler methionine source

As a dry product, MetAMINO[®] can be added to dry feed at any point during the mixing process. Liquid MHA-FA requires longer mixing time as it may only be added once all dry ingredients have been compounded in order to avoid lumps. Mixing liquid MHA-FA can also be a problem when temperatures drop below 10 °C (50 °F). It often requires additional heating equipment to prevent the fluid from developing viscosity problems. These factors can make liquid MHA-FA more difficult to mix accurately and reduce mill throughput (figures 7 and 8).

Several aspects of mill management make MetAMINO[®] a superior product to liquid MHA-FA. Liquid MHA-FA is corrosive to your mill equipment, wearing down your pipes and mixers. Its high acidity can be hazardous to workers' health if contacted directly. These problems can be avoided with the non-corrosive quality of MetAMINO[®].





Figure 6. Nitrogen Retention in Pigs



Relative effectiveness

DL-Methionine (x1) = 100%Liquid MHA-FA (x2) = 62%

🔺 DL-Methionine 🛛 Liquid MHA-FA Control

MetAMINO° vs. liquid MHA-FA

Nitrogen retention in piglets when supplying graded levels of liquid MHA-FA or MetAMINO[®] (Hohenheim University, Germany; Schindler et al., 2000)



MetAMINO® Liquid MHA-FA

MetAMINO° vs. liquid MHA-FA

Results of 514 mixer profiles, analytical determination of coefficient of variation in compound feed, 10 samples per mixer profile.

Figure 8. Average Mixing Time



MetAMINO° vs. liquid MHA-FA

Average mixing time for MetAMINO[®] vs. liquid MHA-FA under typical operating conditions.



You can't argue with science or money

The facts all point in one direction – MetAMINO[®] is the most effective source of methionine supplementation in the market. Over the years, scientific and practical field trials have repeatedly demonstrated that liquid MHA-FA is less effective and often over-priced. For all that, Evonik stands behind MetAMINO[®].

When you work with Evonik, you have the experience and support of a worldwide leader also on your side. You have access to excellent services like AMINODat[®], our database of more than 28,000 feed samples to help you fine-tune your animals' diet. And our analytical services such as AMINONIR[®] are second-to-none in the industry. You have the benefit of excellent customer service, on the phone, on the web or in person. Most importantly, you have a reliable source of methionine that will never let you down and always build your bottom line.

See it first-hand

We will be happy to set up a side by side comparison of our product versus any liquid MHA-FA. Contact your Evonik sales representative and you'll see your animals respond to MetAMINO[®] and your annual profits respond to a smart decision.

Side by Side Comparison

	MetAMINO®	Liquid MHA-FA
MakeUp	Amino acid	Blend of monomers, dimers, polymers and water
Purity	> 99 % pure	88% pure
Bioefficacy	Fully effective	Only about 65% on average as biologically effective as MetAMINO [®] across species*
Absorption	Immediately absorbed in animal	Absorbed slowly and less efficiently
Nitrogen Excretion	Less nitrogen excretion than liquid MHA-FA**	More nitrogen excretion than MetAMINO***
Mixability	Can be added anytime during mixing process	Must be added after dry ingredients
Mill throughput	Full utilization of mixing capacity	Extended mixing cycle times
Dosing	Mixable at any temperature	Causes viscosity problems below 10° C (50° F)
Safety	Safe to work with	Can be dangerous if contacted directly
Corrosiveness	Non-corrosive product	Corrosive, can be damaging to mill equipment

* This is the result of a data review on more than 70 scientific dose response trials in broiler, layers, turkeys and pigs (Lemme and Petri, 2003). Average bioefficacy values differed between species and between performance criteria within species.

** assuming liquid MHA-FA is formulated at higher than 65% bioefficacy.

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