Rhodimet®AT88* offers a way to acidify feed when supplementing methionine

By Dr. Yves Mercier, expert in methionine research, Adisseo

When balancing feed with sulphur containing amino acids, feed producers have the choice between DL-Methionine (Rhodimet®NP99) and Methionine Hydroxy-analogue (Rhodimet®AT88). The HMTBA molecule of Rhodimet®AT88 has similar acidifying benefits as organic acids molecules and participates on controlling the growth of feed moulds and improving intestinal micro flora and nutrient digestibility.

In Rhodimet®AT88, the NH2 group of methionine found in DL-methionine is replaced by an OH-group, which gives it similar properties to organic acids. The pKa of Rhodimet®AT88 is lower than the pKa of most of feed acidifiers such as propionic, sorbic or acetic acid and equivalent to pKa of formic and lactic acid. The acidifying value of Rhodimet®AT88 is largely proven by experimental results reported in scientific publications and communications.

**Control of feed moulds at standard incorporation rate of Rhodimet®AT88**

*In vitro* tests have shown that Rhodimet®AT88 strongly inhibits mould development (up to -50% for *Aspergillus flavus* or *Fusarium verticillioides*) at standard feed incorporation rate (2.5 kg/ton). In another test, 1 kg of Rhodimet®AT88 appeared even as efficient as 1.25 kg of potassium sorbate on *Fusarium gramineum*.
Rhodimet®AT88 helps the gastric acidification
A well-known effect of organic acids is the enhanced gastric acidification, especially for post-weaning piglets. *In vitro* trials carried out on a monogastric gut model (TIM) in CERN laboratory of Adisseo prove that Rhodimet®AT88 decreases the need for HCl gastric secretion to achieve a target pH of 2. This is due to the capacity of Rhodimet®AT88, as an organic acid, to reduce the buffer effect of the diet (see explanations on ABC-4 value). Moreover a low buffer effect in feed may enhance the antimicrobial effect of organic acids as only the non-dissociated form (when pH is below pKa) is active against bacteria.

![Figure 2 Rhodimet®AT88 enhances gastric acidification in a gut model (Source: Internal trial on TIM. 2005)](image)

Reduction of ABC-4 value enhances digestibility
Data from scientific publications show that the ABC-4 value of feed is critical to reach optimal crude protein digestibility. ABC-4 values have been calculated in diets and related to crude protein digestibility results on piglets on wheat based diet (Mroz et al., 2000) and corn based diet (Blank et al., 1999; Falkowski and Aherne 1984). In piglets, the ABC-4 value should be between 200 and 300 mEq H+/kg to maximise crude protein digestibility.

![Figure 3 Optimal ABC-4 value of feed for maximum crude protein digestibility in piglets](image)
In poultry, the ABC-4 value should be between 120 and 170 mEq H+/kg to maximise crude protein digestibility (Ghazalah et al., 2011).

**Inhibition effect on bacteria is also proven**
Rhodimet® AT88 has also a positive effect on gut micro flora. It clearly reduces the total micro flora growth. Considering total gas production in the gut, Rhodimet® AT88 has similar effect to formic or fumaric acids. Associated with organic acids (butyric, formic or fumaric acids), the inhibitory effect on bacteria growth is better than only organic acids. This effect is particularly significant against *Campylobacter jejuni*, as shown through *in vitro* cultures, while beneficial flora – *lactobacillus* and *bifidobacterium*– is not altered.
*In vivo* trials also prove the efficiency of Rhodimet®AT88 on Campylobacter in the gut on broilers. Several trials in the world show its specific and strong effect on Salmonella (*Salmonella pullorum, Salmonella typhimurium, Salmonella enteritidis*) and *Clostridium perfringens*. The efficacy is similar to that of potassium diformate or formic acid, and better than lactic acid.

These properties are of great interest regarding to human health. *Campylobacters* are considered as the main bacterial cause of human gastro enteritis, especially *Campylobacter jejuni*, via chicken meat. Salmonellas are the second most reported cause of food-borne illness in human in Europe, especially *Salmonella enteritidis* and *Salmonella typhimurium*. 
The ABC-4 method, the most suitable to describe acid-base phenomenon
Dr. Yves Mercier, expert in methionine research, Adisseo

To measure buffering capacities of feed, the Acid Binding Capacity developed by Lawlor et al, 2005 seems the most suitable for monogastrics. ABC-4, expressed in mEq/kg, gives the amount of HCl needed to bring 1 kg of feed from its initial pH to pH4, pH for which most data are available.

ABC values of each ingredient are additives, allowing a calculation of the ABC-4 value of a feed. We know that the higher is the ABC-4 of a feed, the lower are the crude protein and energy digestibility. That is why strategies to decrease the ABC-4 value of feed are required. « The aim is to lower the ABC value of the diet as low as possible in order to reach the optimum gastric pH as soon as possible » explains Dr Yves Mercier, expert in methionine research at Adisseo.

Adisseo has developed a table value for each product and raw material on this criterion, helping for feed optimization. For example, cereals have an ABC-4 value from 91 to 113 mEq/kg, while organic acids have a negative ABC-4 value, -17 000 mEq/kg for formic acid, or –3000 mEq/kg for butyric acid. The ABC-4 value of Rhodimet®AT88 is about –5 000 mEq/kg, a negative value similar to most of the organic acids used in feed.

« The ABC-4 values of each product and raw material help for feed optimization, with the objective to lower the ABC value of the diet »

<table>
<thead>
<tr>
<th>Positive and negative ABC-4 values of ingredients (mEqH+/kg)</th>
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<tbody>
<tr>
<td>Wheat</td>
</tr>
<tr>
<td>Soyabean meal</td>
</tr>
<tr>
<td>Molasses</td>
</tr>
<tr>
<td>Calcium carbonate</td>
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<tr>
<td>DL methionine</td>
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<tr>
<td>Formic acid</td>
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<tr>
<td>Butyric acid</td>
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<tr>
<td>Rhodimet AT88</td>
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</table>

Source: Lawlor et al, 2005 and Adisseo

For a more practical use of the acidifying potential of Rhodimet®AT88, Adisseo has developed a simple calculator to determine the acid equivalence of Rhodimet®AT88. This calculator is available upon request to Adisseo representative.

* This product documentation has been developed to comply with United States of Americas laws. Legal status of our products may vary from country to country. Customers are invited to consider and assess compliance with local applicable regulations prior to use our products.