Algae and clay tested to improve pigs' ileal digestibility

Maximising feed efficiency depends primarily on the quality of both nutrients and the digestive process. Natural enzymatic digestion in the small intestine is a key factor for optimal nutrient utilisation.

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In recent years, several studies pointed out the ability of clays to increase the activity of digestive enzymes in the small intestine via the formation of stable clay-enzyme complexes thus improving nutrient digestibility.

Furthermore, the presence of metallic ions in the clay may contribute to the activation of some enzymes, through their action as cofactors.

Clay-enzyme complexes

Digestive enzymes need to be in contact with their substrate in order for hydrolysis to occur.

The physico-chemical interactions of the enzymes with clay particles seem to enhance the contact between the digestive enzymes and the feed, making clays a good supporting matrix for enzymes and acting as a meeting point for them to be in contact with their substrate. Indeed, clay-enzyme complexes are formed at enteric pH values. These active stable complexes are resistant to proteolysis and increase the amount of active digestive enzymes in the intestine, thus improving nutrient digestibility.

It has been observed that clay supplementation in different animal species increased digestive enzymatic activity: higher pancreatic lipase activity in rats supplemented with Kaolinite; increased digestive enzymatic activities in small intestine in broilers supplemented with Montmorillonite and increased protein and energy retention coefficients for growing pigs supplemented with clay.

Some studies also suggest that the increased activity of enzymes in contact with clay not only comes from their stabilisation, but also from the presence of cofactors in the clay.

Cofactors are helper molecules required for enzymes to be active. They can be organic or inorganic, most commonly vitamins in the first case and metallic ions in the latter.

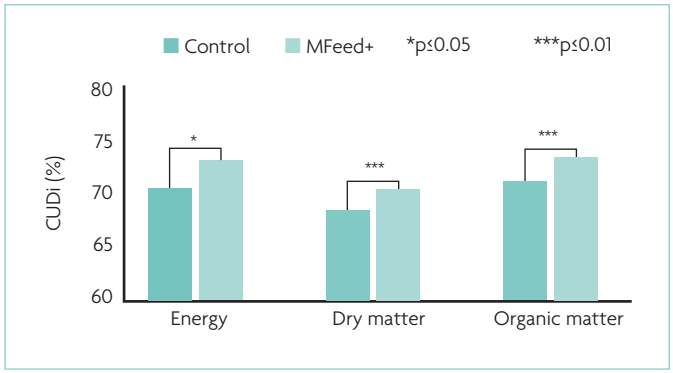
Clays are layered mineral materials, composed of a succession of aluminium and silicon based sheets, the order of which varies according to the type of clay.

In Montmorillonite, various metallic ions replace some aluminium and silicon ions in the structure. Known as the substitution phenomenon, this event provides Montmorillonite part of its physico-chemical reactivity. Moreover, the presence of metallic ions may contribute to the activation of some enzymes, through their action of cofactors.

For example, copper is known to activate lipase and phospholipase A and zinc is a required cofactor of carboxypetidase, to mention only a few examples.

Digestibility crates during INRA trial of MFeed+.

Fig. 1. Apparent ileal digestive utilisation coefficient (CUDi).



Seaweed-clay synergy

The combination of the matrix support provided by the clay and the cofactor effect coming from the metallic ions present in its structure can be referred to as biocatalysis: the improvement of performance of a biochemical reaction through the action of an external compound, a biocatalyst.

Clay structures can be modified and associated with other materials in order to potentiate its biocatalytic properties. Such technology has been developed by Olmix group (France) in the frame of its research program conducted on seaweeds and clays.

The micronised form allows a fine dispersion of the product in the intestine, providing many sites of reaction of enzymatic digestion with more easily accessible metal ions.

Moreover, it benefits from a synergy between clay and seaweeds in the process of biocatalysis, as seaweeds bring in many diverse metallic ions, sometimes absent in the feed, which are required cofactors for the activation of several enzymes.

This unique combination of seaweeds and clay makes MFeed+ a unique tool to boost enzymes activ-

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ities through the action of biocatalysis.

Proven efficacy

MFeed+, being the only product benefiting from this new technology, has proven its efficacy in several studies.

In a recent study conducted by INRA Saint-Gilles (French National Institute for Agronomic Research) MFeed+ was successful to improve ileal digestibility performance of growing pigs.

In order to evaluate the ileal digestibility performance of the animals, five pigs (average weight 30kg) underwent ileorectal anastomosis (removal of the large intestine) and were placed in individual cages.

Three weeks after surgery, the pigs received the three diets of the study consecutively, following a Latin square model:

- The standard diet (control).
- The standard diet supplemented with 0.1% of algae-clay mix (MFeed+).
- A low protein and low energy diet (LP-LE), used to estimate endogenous losses.

None of the studied diets contained exogenous enzymes.

Ileal and standardised digestive utilisation coefficients (CUD) were calculated for dry matter (DM), organic matter (OM), nitrogen (N), CF (crude fibre), NDF/ADF (neutral detergent fibre/acid detergent fibre), (gross energy) GE and amino acids (AA).

Variations due to the different diets in the Ileal and Standardised CUD were calculated using ANOVA test. PRO MIXED SAS software was used to conduct all statistical analysis with a significant level of 5%.

When compared to the standard diet, MFeed+ diet presented significantly increased apparent ileal digestive utilisation coefficient (%) of gross energy (GE), dry matter (DM) and organic matter (OM), respectively being (+3.4%, P≤0.05), (+3.4%, P≤0.01), (+3.1%, P≤0.01), (Fig. 1).

MFeed+ diet also showed significantly increased standardised ileal digestive utilisation coefficient (%) for non-essential amino acids (+3.8%, P≤0.01), lysine (+3.6%, P≤0.01) and threonine (+5.3%, P≤0.01) (Fig. 2).

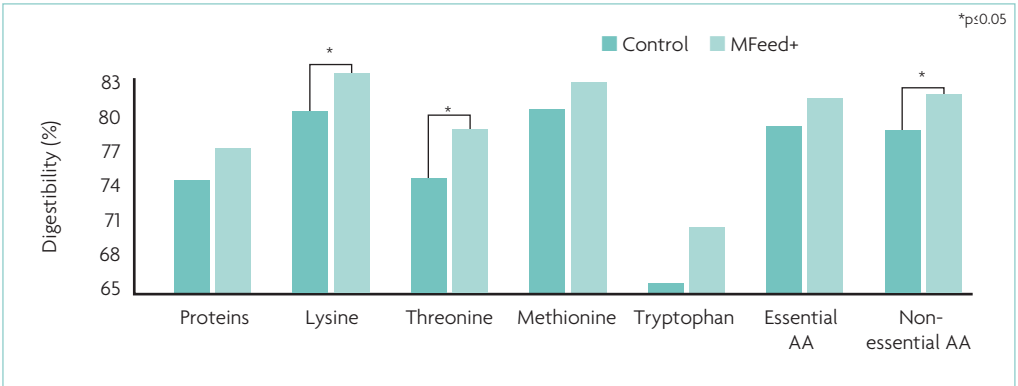

Fig. 2. Standardised digestibility of amino acids.

Conclusion

Feed cost is currently the most important input cost in animal production systems.

In order to accomplish a maximum zootechnical and health performance in this economic scenario, the improvement of nutrient digestibility is paramount.

This study proves that the addition of a mix of seaweed extracts and clay minerals improves the efficacy of digestive enzymes, allowing a better use of the diet and helping reduce the cost of production. ■

References are available from the author on request

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