Combination of seaweed and clay: a new tool to improve feed efficiency

Seaweeds are being increasingly explored for their nutritional, structural and biological properties. For 20 years, Olmix has developed marine biotechnology for animal, vegetal and human care. Olmix is specialised in the identification, characterisation and extraction of specific seaweed extracts from green, red and brown algae.

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Among them, a type of extract with biological properties was identified and is being used in combination with micronised montmorillonite for its capacity to improve feed efficiency.

Seaweeds, or macroalgae, are eukaryotic and pluricellular organisms, divided into three different groups: green, red and brown. They contain a variable part of carbohydrates (mainly polysaccharides), proteins, minerals, lipids and vitamins. Olmix focuses mainly on the extraction of seaweed polysaccharides.

Nutritional studies

Nutritional studies on marine algae indicate that green, brown and red seaweeds possess good nutritional characteristics and could be used as an alternative source of dietary fibre, protein, vitamins and minerals.

In addition, detailed screening of macroalgae functions revealed that they contain a high level of diverse metallic ions (iron, zinc, copper, titanium, etc) which act as cofactors of enzymes and favour their efficacy.

Cofactors are defined as thermostable compounds that form the active portion of an enzyme system. In other words, cofactors are helper molecules required for enzymes to be active. They can be inorganic such as metallic ions. Thereby, copper is known to activate lipase and phospholipase A and zinc is a required cofactor of carboxypetidase, to mention only a few examples.

In summary, seaweeds bring in many diverse metallic ions, sometimes absent in the feed, which are required cofactors for the activation of several enzymes.

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

In montmorillonite, several metallic ions replace some aluminium and silica ions in the structure. Known as the substitution phenomenon, this event provides montmorillonite part of its physico-chemical reactivity. As for seaweed, the presence of metallic ions may also contribute to the activation of some enzymes, through their action of cofactors.

Clays and enzymes activity

Older studies suggest that the increased activity of enzymes in contact with clay not only comes from the presence of cofactors but from their stabilisation. The dominant hypothesis described in the literature is that clays slow down the transit of feed in the intestine, so the time for digestion is increased, hence a better digestibility of feeds and nutrients uptake.

Such an effect has been described for growing pigs, as supplementation with clay increased their speed of growth between 25 and 106kg and improved their carcase quality (higher lean meat).

Weight gain and feed efficiency of broilers has also been improved when the feed was supplemented with

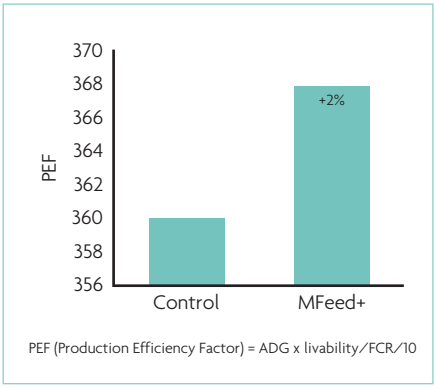

Fig. 1. Production Efficiency Factor (PEF) of commercial broilers in a field trial in Poland.

montmorillonite. In both studies, the stressed mode of action was a decrease in transit speed.

Nevertheless, it seems that the action of clays to enhance feed digestion in the intestine involves other mechanisms. Reichardt (2008) and Habold et al (2009) both report the ability of clays to favour the contact between enzymes and nutrients, and therefore to improve the rate of digestion of the feed. Indeed, digestive enzymes need to be in contact with their substrate for hydrolysis to occur.

Good supporting matrix

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, Cabezas et al (1991) demonstrated that clay-enzymes 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.

Micronisation is a specific process that allows a fine dispersion of the montmorillonite in the intestine, in order to increase the number of sites of reaction of

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enzymatic digestion compared to a standard montmorillonite.

Olmix technology first uses a micronised montmorillonite produced thanks to a specific drying and ball milling process. This specific micronised montmorillonite is then complexed with green and red seaweed extracts for their high content in rare metallic ions. The final combination of seaweeds and micronised montmorillonite leads to a unique tool to boost enzyme activity through the action of biocatalysis.

MFeed+ is the only product benefiting from this innovative technology and has proven its efficacy in several trials.

Improved ileal digestibility

The first study implemented to validate the efficacy of this new technology on monogastrics was conducted by INRA Saint-Gilles (French National Institute for Agronomic Research). MFeed+ was successful in improving the ileal digestibility performance of growing pigs.

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).

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).

In a poultry study conducted by an independent research centre in France in a conventional farm, MFeed+ successfully improved the performance of broilers fed a corn-wheat based diet using by-products. Growth performance was increased by 7% in comparison with non-supplemented diets for the whole period (+12% in finishing phase), and was equivalent to the growth rate observed in broilers fed a standard corn-wheat based diet.

Investigators thus highlighted the interest of using MFeed+ in diets using by-products, as a way to decrease the feed cost. With by-products like corn DDGS being more and more present on the market, though not used widely because of their nutritional profile, such an outlet is a great perspective to manage feed cost, while ensuring optimum performance of the feed.

Improved broiler performance

In another experimental study conducted in a Midwest feed company research centre in the USA, MFeed+ also proved its capacity to improve performance in broilers. The study was run on corn-soy based feed and also contained cereal by-products: 9% of wheat middling, 3% of corn gluten meal and 2% of corn DDGS in the starter feed and 9% of corn DDGS in the grow-to-finish feed.

Both feeds contained several digestibility enhancers, including a protected butyric acid and different enzymes (phytase, xylanase, protease and amylase).

In this study, the growth rate of the MFeed+ group was higher in all phases in favour of the test group (+1.4% on average) and feed efficiency was improved by 1.6% on average.

The improvements in performance resulted in a positive return on investment (ROI) of 2:1.

In a recent field trial conducted in Poland in a commercial broiler farm with more than 254,000 birds fed standard corn-wheat based diets, MFeed+ improved feed efficiency (+1.0%), increased final body weight (+30g), and by better utilisation of nutrients from the feed and lower amount available for pathogenic micro-organisms decrease mortality (1.73% vs. 2.66%).

This improved performance resulted in an ROI of 1.5:1.

MFeed+ appears as a great perspective to manage feed efficacy ensuring optimum performance of the feed. ■

References are available from the authors on request