The 3rd generation

Baracid BLC (dry or liquid)

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RAW MATERIALS

The value of organic acids in monogastric diets

Successful feed formulations must both promote the growth of the animal and discourage the growth of pathogenic bacteria in the gastrointestinal tract. Feeding for health as well as nutrition is certainly a major criterion in the design and formulation of piglet and poultry feeds.

Organic acids are used in feeds for their various beneficial effects: feed preservation to control microbial growth, reduction of the feed buffer capacity, inhibition of pathogenic bacteria and improvement of nutrient digestibility. These effects will result in improved growth performance and improved profitability of pig and poultry production.

Synergistic Effect

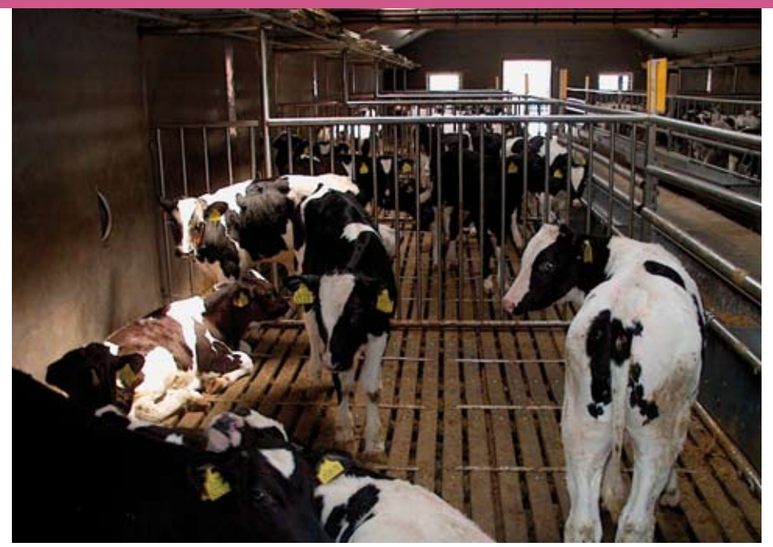
Due to their different chemical structures, different acids have different properties and the response to diet acidification may be affected by type of acid, inclusion level, diet composition and dietary buffering capacity (especially in young pigs). The traditional 'one-acid-fits all' strategy has been replaced by the design of acidifier blends since such a blend will combine the positive properties of different acid types. Combining the acids may increase the range of desirable antimicrobial effects.

The key basic principle on the mode of action of organic acids on bacteria is that non-dissociated (non-ionized) organic acids can penetrate the bacteria cell wall and disrupt the normal physiology of certain types of bacteria. We call these bacteria "pH sensitive" meaning that they cannot tolerate a wide internal and external pH gradient. Among those bacteria we have E.coli, Salmonella spp, C.perfringens. It has been well demonstrated that the state of the organic acids (non-dissociated or dissociated) is extremely important to define their capacity to inhibit the growth of bacteria.

As a general rule, we need more than ten to twenty times the level of dissociated acids to reach the same inhibition of bacteria, compared to non-dissociated acids. Amongst the wide range of organic acids used in animal nutrition both lactic acid and butyric acid take an unique position. ■

Lactic Acid + Butyrate + Essential oils = Synergy

Of the various acids available lactic acid is certainly one of the most valuable. Lactic acid has attractive properties for use in the feed industry. It is a product widely prevalent in nature. It is naturally present in the human body and commonly used in many food industry applications. The product is GRAS (Generally Recommended As Safe), non-corrosive, safe in handling and processing. Lactic acid has a mild taste and seems to have a favourable influence on feed intake, average daily growth and feed-to-gain ratio. This acid is also a strong stimulant of pancreatic secretion. Lactic acid inhibits the growth of many species of bacteria and to a lesser extent yeasts and moulds, and as well as remaining active in small intestine, also provides a useful energy source. It is also produced naturally in the gut of the piglet by fermentation of the lactose in sow's milk. Supplementation of piglet feed with a lactic acid-based acidifier should give the young piglet a certain continuity in conditions within the gastointestinal tract as it adapts to the new and different feeding regime imposed at weaning.



Lactic acid and the chicken crop

Microbial fermentation of starch and sugars in the chicken crop yields lactate and this production of lactic acid can be considered as an important defense mechanism for prevention of colonization of pathogens. In full-fed broilers, fermentation of feed in the crop creates conditions that inhibit Enterobacteriaceae growth. However young broilers and broilers with feed withdrawal will lack this natural defense system. Within 6 h after feed withdrawal is initiated, the crop of broilers is emptied of feed significant decreases in the population of lactic acid bacteria in the crop occur; and significant increases in crop pH occur. Additionally, concentrations of acetic, propionic, and lactic acid in the crop decrease during feed withdrawal.
Both the crop and caeca are especially prone to bacterial contamination.

Eight to 10 hours before slaughter, broiler chickens are usually taken off feed to reduce intestinal contents. During this time, they look for food and peck at whatever is on the ground. What the birds eat enters the crop and is slowly released into the stomach. If Salmonella is present, the highest concentration is found in the caeca. But the amount of bacteria in the crop is also significant because it ruptures 86 times more often than the ceaca during processing. Lactic acid supplementation reduces Salmonella in two major organs in broiler chickens. Research has shown that by adding 2 tablespoons of lactic acid to 5 liters of the chickens' drinking water, Salmonella was reduced by 41 percent in the crop and by 11 percent in the caeca, compared to birds drinking plain water.
Lactic acid acidifies crop contents, making them less conducive to bacterial growth. Acidified drinking water could therefore play a crucial role in a biosecurity strategy of preventing pathogens like Campylobacter and Salmonella in broiler flocks.

Buytrate, a versatile organic acid

In pigs and especially young/weaner pigs, the use of acids is widespread throughout Europe since the efficacy of organic acids in pig nutrition has been proven time after time.
Although less used compared to pigs, the potential of specific organic acids in poultry diets has been shown in recent years when respecting the specific physiology of poultry. Especially the added value of butyrate, in a coated (micro-encapsulated) or protected form, has become obvious both in practice and in scientific studies.
Acids from feed or drinking water are not effective further down in the intestinal tract, unless these acids have been administered in a protected form, as the colonization of pathogens (like Salmonella, Clostridium perfringens) is mainly located in the hindgut and caeca.

The efficiency of our butyrate product is based on the protection by esterification with glycerol (butyrate glycerides), which allows the butyrate molecule to bypass the stomach and to reach the distal sections of the GI tract. There it can exert its specific and unique function:

1 It fuels the gut mucosa cells by providing 50% of the daily energy requirements of the gut and consequently plays an important role in the prolifera
2 It stimulates the development of a favorable intestinal flora (e.g.Lactobacilli)
3 It reduces the colonization and invasiveness of Salmonella in the gut (caeca), both in pigs and poultry
4 It reduces the risks for incidence such as necrotic enteritis (Clostridium perfringens) and Colibacillosis.
5 It enhances the barrier function of the intestinal epithelium since butyrate upregulates the expression of tight junction proteins (='glue' joining the epithelial cells together)

Butyrate administered in feed for piglets and broilers in concentrations up to 0.2% increases feed efficiency, daily weight gain and intestinal villus length. Ongoing scientific studies indicate protected butyrate may help to reduce the Salmonella load in pigs as well as poultry. Nowadays, this short chain fatty acid is considered as a major aid to reduce the number of infected animals and contributes to a substantial reduction of human food-borne Salmonellosis.

Phytogenic substances

Natural plant or herbal extracts are yet another potential viable alternative to traditional antimicrobials. Phytogenic substances are made of essential oils, essential oil components, plant extracts, herbs and spices.

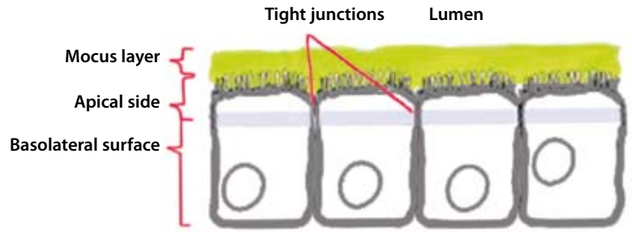


Figure 1. Schematic representation of the tight junctions between gut epithelial cells

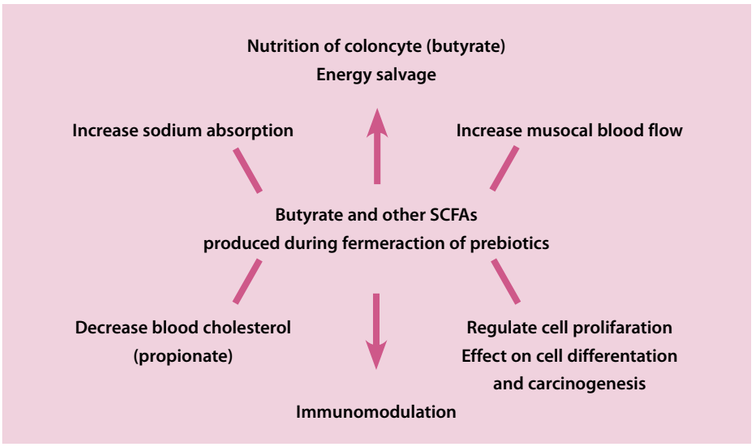


Figure 2. Flowchart summarizing the different mode of actions of butyrate in the gut.

Phytogenic substances have been shown to affect performance, gut physiology and gut microbiota of farm animals. Some of the insoluble plant parts stimulate enzyme secretion and bile acid production.
Essential oils are highly concentrated extracts produced by further refinement of plant extracts (botanicals) by hydro-distillation. Essential oils are standardised products such as allylisothiocyanates (from garlic), thymol,

carvacrol, cinnamaldehyde, capsaicin, eugenol and others. These substances have antimicrobial, antioxidant, coccidiostatic and even antiviral properties. Claims are also made for increased digestive enzyme secretion and improved immune function. In-vitro studies had shown essential oils to have powerful antimicrobial effects. However the "in vitro" level of most of the essential oils needed to reach a MIC (Minimal Inhibitory Concentration) on various bacteria is high and not applicable in animal nutrition. The shift towards a beneficial gut microflora after ▶

administration of phytogenics is due to its physiological actions on the digestive tract: enzyme secretion, mucosa protection (antioxidant effect) and microflora equilibrium. They are also very volatile and will evaporate rapidly, leading to large variation in concentration in the finished products. Encapsulation of essential oils could solve the problem.

The mode of action of phytogenic substances

It is extremely difficult to generalize on the mode of action of essential oils (EO) on bacteria and yeasts because each EO has different properties and each type of microorganism has a different sensitivity.

Generally, Gram+ bacteria are considered more sensitive to EO than Gram- bacteria because of their less complex membrane structure. The consensus on the mode of action of EO on bacteria is now that these compounds influence the biological membranes of bacteria.

More and more, the concept of combining essential oils and organic acids is proving to be efficacious because there appears to be a synergy between the two concepts.

Experiments in field trials or when using a chicken necrotic enteritis challenge model have shown a strong synergy between both type of products. The synergy is thought to come from the ability of the plant extracts to weaken bacterial cell walls, increasing its permeability to the organic acids. Some authors suggest that the EO are damaging the bacteria cell membrane facilitating the penetration of organic acids into the bacteria cytoplasm. It has been demonstrated that when both types of products are protected in a special matrix, the quantity required to achieve maximum performance in pigs and poultry can be reduced drastically. The active ingredients can be delivered into the intestine, directly where the bulk of gastrointestinal bacteria are located. Without protection, organic acids are readily dissociated in the first part of the GI-tract and are rendered useless. Essential oils are very rapidly absorbed in the duodenum and cannot interact with the microflora further down the GI-tract.

Conclusion

There is a general consensus on the efficacy of lactic acid and butyrate as one of the best alternatives to antibiotic growth promoters. Phytogenic substances act in synergy with organic acids both for their growth promoting effect and prevention of specific intestinal diseases.

Now we have an encapsulation technology that enhances the efficacy of organic acids and essential oils, at low level of inclusion. ■