Acidifiers in aquaculture prove beneficial

THE USE OF ORGANIC ACID SALTS OR ACID BLENDS SHOWED POSITIVE RESULTS IN A WIDE VARIETY OF AQUACULTURE SPECIES WORLDWIDE. IN THIS ARTICLE, CHRISTIAN LÜCKSTÄDT ADDRESSES HOW THE USE OF ACIDIFIERS CAN BE AN EFFICIENT TOOL TO ACHIEVE SUSTAINABLE AND ECONOMICAL PRODUCTION IN MODERN AQUACULTURE

Dr. Christian Lückstädt's background in fisheries and aquaculture stems from his upbringing on the Baltic coast of Germany. It continued through to his Ph.D. in feed intake and utilisation of commercially raised juvenile milkfish in the Philippines, which he completed in 2004 at the University of Hohenheim. Since 2003 he has been employed with Biomin Deutschland as product manager, responsible for the acidifier Biotronic.

The promotion of environmentally sound practices in all fields of fish and shrimp production is a relevant point for the aquaculture industry if sustainability is to be achieved (Williams *et al*, 2000). Growing awareness from consumers and producers has resulted in calls for responsible and sustainable aquaculture. Public opinion and regulation authorities in most export countries focus now on the misuse of antibiotics in aquaculture, and public attention has shifted towards production methods (Verbeeke, 2001; Feedinfo, 2005). Furthermore, the EU has banned all antibiotic growth promoters from livestock production with effect from January 2006, since the use of low levels of these antibiotics in animal feeds possesses the possibility to transfer bacterial immunity to species pathogenic in animals and humans (Liem, 2004).

In the field of aquaculture it is well established so far that the inclusion of antibiotics into the diets of fish (Ahmad and Matty, 1989) can promote growth and feed conversion. Due to the abovementioned facts however, alternatives needed to be found.

Since the production of fish silage has been common practice for decades (Gildbert and Raa, 1977) the idea of including acidifiers directly into the pelleted fish feed recently gained ground, and several trials have been conducted with different species including carnivorous

species, like rainbow trout Oncorhynchus mykiss and artic charr Salvelinus alpinus, but also with herbivorous filter feeders, like tilapia.

SCIENTIFIC BACKUP

In a recent trial, the inclusion of organic acid salts in fish diets was tested in rainbow trout (de Wet, 2005). This study aimed to evaluate an organic acid blend (5-15 kg/t), mainly consisting of formate and sorbate, for its use in trout nutrition to improve performance parameters. The organic acid blend was compared with some commonly used antibiotic growth promoters (40 ppm Flavomycin). Rainbow trout fingerlings (ca. 40 g) were kept in flow-through ponds and fed there three times daily to apparent satiety. The experiment lasted for three months.

Fish feeding on 10 and 15 kg acidifier per ton of feed had significantly higher final weights compared to the negative control group, while there was no difference to the group treated with AGP. Feed conversion ratio tended to be lower with increasing dosages of the acid blend, even compared to the AGP group.

The results of this study show that the application of the acidifier at 15 kg/t improves weight gain and feed conversion ratio in trout compared to a negative control by 20.1% and 14.8% respectively. This data surely proves that an organic acid inclusion is suitable for use in rainbow trout grower feeds at and above levels of 10 kg of acidifier per ton of finished feed, and that this level can be an effective alternative to the use of AGPs in trout aquaculture.

Previous studies have also shown the beneficial effect of including organic salts in fish feeds for other species. The effect of supplementation of commercial diets with sodium salts of lactic acid (10 kg/t of feed) was tested in Arctic charr under brackish water conditions at 8°C (Ringø, 1991). Fish fed the diet with added Na-lactate increased their weight from around 310 g to about 630 g within 84 days of the experiment, while the difference to the negative control group (final fish weight: 520 g) was significant ($p<0.05$). The gut content from Arctic charr fed the sodium-lactate supplemented diet contained significantly ($p<0.05$) lower amounts of water, energy, lipids, protein and free amino acids. It has been observed that charr feeding on high doses of commercial feeds, as often occurs under aquaculture conditions, have a tendency for diarrhoea. When charr was feeding on Na-lactate no nutritive diarrhoea appeared, probably because of much lower amounts of remaining nutrients and water in the gut. Furthermore, it was proposed that the growth promoting effect of dietary lactate in Arctic charr is caused by the relatively slow gastric emptying rate (Gislason *et al*, 1996). An increased holding time in the stomach enhances the antibacterial potential of the lactic acid salt, therefore more effectively inhibiting pathogenic bacteria (Sissons, 1989). The improved growth of the Artic charr did not affect the chemical composition of the fish (Ringø *et al*, 1994).

TABLE 1 – INFLUENCE OF DIETARY TREATMENT WITH AN ORGANIC ACID BLEND ON RAINBOW TROUT ONCORHYNCHUS MYKISS PERFORMANCE COMPARED TO AN ANTIBIOTIC GROWTH PROMOTER (AGP)*.

Parameter	Control	AGP	5 kg / t acidifier	10 kg / t acidifier	15 kg / acidifier
Initial weight (g)	40.3	42.3	40.0	37.3	37.2
Final weight (g)	184.8^{a}	235.4^{b}	205.6^{ab}	231.2^{b}	231.4^{b}
FCR	1.22	1.10	1.09	1.08	1.04
SGR (%)	1.23^{a}	1.37^{b}	1.23^{a}	1.29^{ab}	1.37^{b}
Survival (%)	82.7	88.8	85.0	85.8	89.6

ab within rows, means without common superscripts are significantly different ($p<0.05$)

** data from de Wet (2005)*

The use of organic acids however was not only tested in Salmoniformes, but also in tropical warm-water species, like tilapia. Ramli et al (2005) tested the potassium salt of formic acid as a non-antibiotic growth promoter in a tilapia grow-out in Indonesia. In this study fish were fed 6 times a day over a period of 85 days with different concentrations of that organic acid salt (0, 2, 3 and 5 kg/t feed). Furthermore, fish were challenged orally starting on day 10 of the culture period with Vibrio anguillarum at 10^5 CFU per day over a period of 20 days.

Over the whole feeding period from day 1 to day 85 the used formate significantly increased the weight gain and feed efficiency in fed tilapia ($p < 0.05$). Survival rates of fish after the challenge with V. anguillarum on day 10 were also significantly higher compared to the negative control, with a dose dependent effect.

The 2 kg/t inclusion of the potassium salt of the formic acid led to an improvement in weight gain and feed conversion ratio in tilapia by 18.6% and 8.2% respectively, and indicated that the chosen acidifier is able to counteract bacterial infections in tilapia.

INTERESTING OPTION

From these studies and trials, it can be concluded that the use of organic acid salts or acid blends is an interesting option to promote the performance of a wide variety of aquaculture species worldwide. It is also suggested that the impact of bacterial infections can be reduced, potentially leading to higher survival rates. The use of acidifiers in aquaculture can therefore be an efficient tool to achieve sustainable and economical fish and shrimp production. <-

References are available on request.