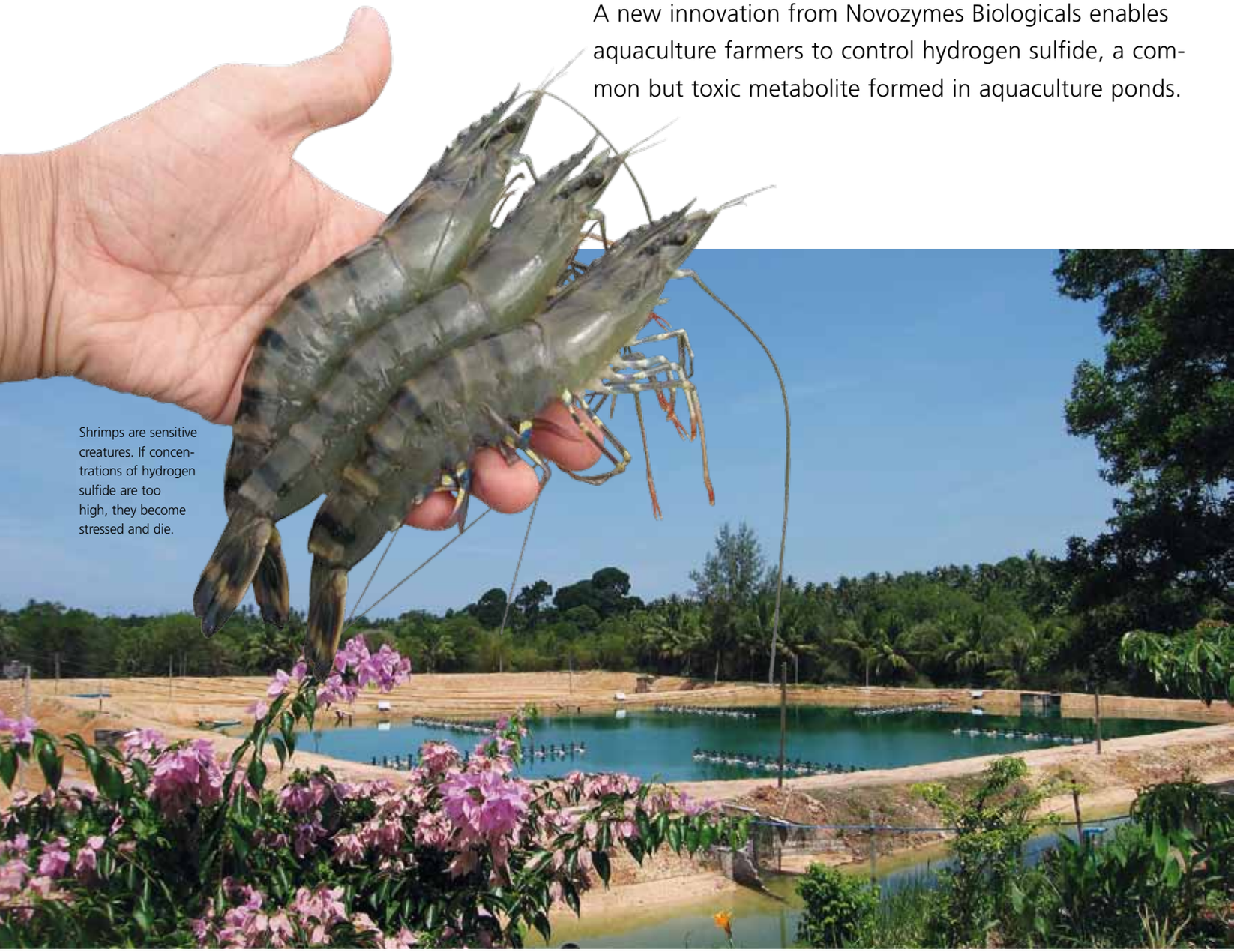
NATURAL SOLUTIONS FOR MORE SUS

A new innovation from Novozymes Biologicals enables aquaculture farmers to control hydrogen sulfide, a common but toxic metabolite formed in aquaculture ponds.



Shrimps are sensitive creatures. If concentrations of hydrogen sulfide are too high, they become stressed and die.

Aquaculture is the fastest growing food sector and is expected to be a key solution for feeding the world's growing population. Today, roughly 30% of all seafood consumed comes from aquaculture production, and this is expected to increase to 50% by 2030. The industry is still in its infancy, and new sustainable innovations are needed to achieve growth.

When aquatic animals are farmed intensively in captivity, the water quality will quickly deteriorate if control measures are not put in place. As waste from the animals accumulates in the pond, toxic metabolites such as ammonia, nitrite, and hydrogen sulfide form. Maintaining the water quality during the production cycle is of paramount importance.

"Without an effective way to manage water quality, you cannot succeed in intensive aquaculture," says Christian Munch, Aquaculture Business Unit Manager at Novozymes. "Poor water quality is a key factor in the outbreak of disease. Even a small deterioration in quality will start to stress the animals. This weakens their ability to fight off disease, and the result is reduced growth and higher mortality."

No need to change water

One common way of dealing with the problem is simply to increase the water exchange rate. But this increases energy costs and the risk of introducing new pathogens, so farmers are reluctant to do this.

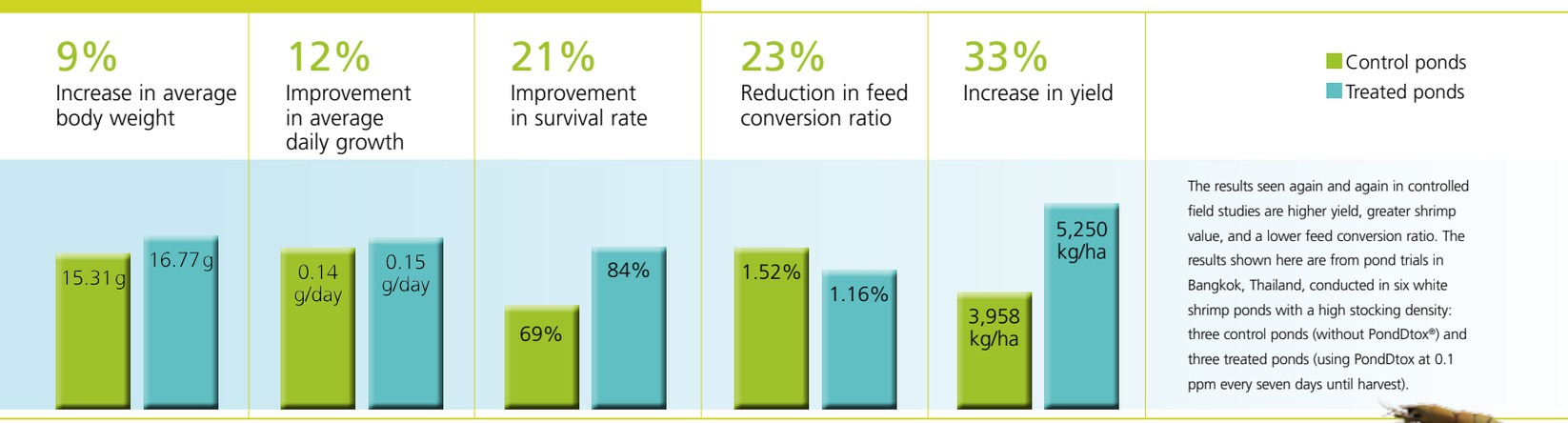
Untreated effluent water from aquaculture facilities is also highlighted as a major environmental concern where the farms are located. The nutrient-rich effluent water can cause eutrophication (algae blooms), which is devastating to an aquatic system as it causes oxygen depletion. In addition, toxins from some types of algae can accumulate and make their way up the food chain, where they can end up posing a risk for humans eating shellfish such as mussels.

In an intensive pond, the natural bacteria in the water are unable to cope with the organic load and buildup of toxins. When Novozymes' microbial solutions are added to a pond, the supplementary beneficial microorganisms break down the toxic metabolites, allowing farmers to

TAINABLE AQUACULTURE

The telltale signs of a hydrogen sulfide problem are bad odor and black sludge at the bottom of a pond.

RESULTS OF POND TRIALS WITH PONDDTOX®



The results seen again and again in controlled field studies are higher yield, greater shrimp value, and a lower feed conversion ratio. The results shown here are from pond trials in Bangkok, Thailand, conducted in six white shrimp ponds with a high stocking density: three control ponds (without PondDtox®) and three treated ponds (using PondDtox at 0.1 ppm every seven days until harvest).

maintain the water quality without the need for water exchange.

Novozymes has been active in the aquaculture market for several years with a biological product called PondPlus®, which is used to maintain water quality and control algae bloom in ponds. In 2007, Novozymes launched PondProtect® to remove ammonia and nitrite. The latest product is PondDtox®, launched on the market in 2009, which enables the prevention and control of hydrogen sulfide.

Hydrogen sulfide

Hydrogen sulfide is a by-product produced by anaerobic bacteria when organic material is broken down in oxygen-free environments. Most people will recognize hydrogen sulfide by the smell, which is like rotten eggs. Studies have shown that a hydrogen sulfide concentration of as low as 0.051 ppm in seawater can lead to mortality of 50% or more of the shrimp population in just four days.

Even the most experienced shrimp farmers can be faced with the buildup of hydrogen sulfide near the pond bottom. An estimated one in three shrimp ponds in Asia is affected by this problem.

As bottom sludge builds up during the later stages of grow-out or after an algae "crash," aerobic microorganisms feed on the organic material and use all the oxygen in the water. Anaerobic (low in oxygen) zones develop where sulfate-reducing bacteria (SRB) take over and convert the natural sulfate in seawater to hydrogen sulfide. Sulfate is also abundant in uneaten food and excreta deposited on the bottom.

Continued exposure to hydrogen sulfide causes the death of aquatic creatures such as shrimps and fish, but long before this they will start to feed less or stop feeding altogether. They also become more susceptible to disease. To avoid hydrogen sulfide that bubbles up into the lower water zone, shrimps may swim higher up, missing out on their normal feeding zone lower down.

A visible difference

The active ingredient of PondDtox is a novel bacterial strain of *Paracoccus pantotrophus,* which very effectively oxidizes hydrogen sulfide to harmless substances and suppresses the SRB strains present. One of the advantages of this strain is its ability to work in almost anaerobic conditions because it requires little oxygen.

"We have many examples of farmers who were looking to do a forced early harvest due to mortality and slow growth induced by hydrogen sulfide," says Christian Munch. "After applying PondDtox, they where able to restore the feeding rate and run the crop cycle to the end. The beneficial microorganisms in PondDtox grow and multiply until they become part of the natural pond bottom material, forming a thin biofilm. Here they will convert hydrogen sulfide to harmless gases as it seeps up from the bottom."

Proven efficiency

The effectiveness of PondDtox has been proven in both laboratory and pond trials across Asia. The results shown in the charts are from pond trials conducted in six white shrimp ponds in Thailand. Three were control ponds, while three were treated with PondDtox. As can be seen, PondDtox gave weight increase, growth increase, lower mortality, higher yield, and an improvement in the feed conversion ratio. This is what makes the product good value for money in treating a problem for which there has previously been no proper solution.

A worldwide patent is pending for PondDtox, which is sold exclusively through Bayer Animal Health in Asia.

PondDtox has been very well received since its launch in 2009. Finally, aquaculture farmers can get to the bottom of the hydrogen sulfide problem. ■

FOR MORE INFORMATION
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