



BioTimes®

ELEMENTAL TEXTILES

– CARING FOR NATURE
EVERY STEP OF THE WAY



Novozymes is the world leader in bioinnovation. Together with customers across a broad array of industries we create tomorrow's industrial biosolutions, improving our customers' business and the use of our planet's resources.

FOOD & NUTRITION

ENZYMES ADD VALUE FOR CHINA'S MEAT PROCESSORS

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There is a huge potential market for a range of meat coproducts – everything from hides to cartilage and bones – that can be transformed into high-quality value-added ingredients through enzyme processing. Three Novozymes products offer a solution that is turning this potential into reality.

According to Helen Hu Ying, Regional Marketing Manager for Novozymes' Food & Nutrition division, slaughterhouses and meat processing plants in China have been using combinations of Novozymes Alcalase®, Novozymes Flavourzyme®, and Novozymes Protamex® for more than 10 years. Until recently, however, enzyme processing was generally limited to extracting meat flavor from meats for use in the production of meat-flavored snacks or packaged noodles.

"In the past few years, we've been showing our customers that enzyme processing can be used in a much wider range of applications to add value to coproducts that previously were often sold raw," says Helen Hu Ying. "We're offering a total solution that allows our customers to process and sell coproducts that they couldn't take advantage of before. This is definitely a win-win solution for our customers. It not only opens up new sales opportunities for them, but is also an environmentally friendly, sustainable solution that significantly reduces energy use, waste production, and processing costs."

Rapidly growing market

China's 1.3 billion population is growing by 10 million people a year. With these numbers and a booming economy, China is one of the world's largest consumers of food. Busy urban consumers want convenience, healthier choices, variety, and quality, which is creating new demands for processed foods. In fact, processed foods account for about 30% of total food consumption in China, and in the last three years they have amounted to approximately 40% of total food consump-



BENEFITS OF ENZYMES FOR MEAT COPRODUCTS

- Broad application
- Increased yield
- Improved product quality
- Environmentally friendly
- Reduced energy and water use
- Lower processing costs
- Reduced salt content
- Less solid waste

tion in urban areas. In 2007, the food processing industry in Shanghai, Guangzhou, and Beijing alone was valued at around USD 172 billion. In addition to China, India, North America, and Latin America also represent big potential markets.

In view of these numbers, it is clear that Novozymes holds the key to helping customers tap into valuable markets by replacing chemical processing with enzyme processing and increasing sustainability and food safety. "The rapid growth of the processed meat industry is producing increasing amounts of coproducts such as trimmings, bones, bone cake, intestines, and greaves that formerly had little value," says Helen Hu Ying. "Enzyme processing gives processed meats a more natural flavor and can help reduce salt and phosphates, which provides health



Enzymes process meat in a more sustainable manner and ensure a healthy and tasty final product.

benefits as well as a more attractive ingredient label for consumers. Our solution adds value that didn't exist before. Or, where it did exist, it came with a high price tag in terms of the expense, energy use, and environmental impact of chemical processing."

Novozymes can help, for example, with applications like meat protein extraction and bone extraction as well as with extraction of GAGs (glycosaminoglycans) from cartilage, connective tissues, and collagen from hides for use in cosmetic and pharmaceutical products.

The preferable choice

There are many other processing applications beyond extraction. Enzymatic processing can, for instance, be used for such widely differing purposes as treating coproducts for use in pet foods and fertilizers and for converting fats to biodiesel. Moreover, enzymes can be used for pretreatment of coproducts that are sold to other companies, resulting in cleaner, higher-quality coproducts that are easier to handle in downstream processing. Equally important, enzymes make better use of raw materials, save water and energy, and almost always replace toxic chemicals.

Jin Lu, Customer Solutions for Food & Nutrition at Novozymes China, explains: "Some meat coproducts can be processed with chemicals, but this raises environmental problems and also

increases costs. People are concerned about food safety, and enzymes can replace many food processing chemicals and make the production of foods a more natural process. There are also other important environmental and cost benefits to enzyme processing."

In addition to chemicals being replaced by enzymatic processes, water consumption is reduced by the use of enzymes in some applications. Enzymes work at much lower temperatures than chemicals. This means that the amount of energy consumed in enzymatic processes is much smaller than when chemicals are used. The increased solubility and reduced water binding of the proteins and other ingredients in the wastewater from processing with enzymes make them much easier to collect and dispose of, which reduces the cost of facility cleanup for meat processors. From yield improvement to increased purity and elimination of waste, enzyme processing is clearly the preferable choice.

The Novozymes solution

The food processing market in China is growing exponentially. Today's estimated 50,526 food processing ventures are projected to increase significantly in the future. "We have a long-standing and strong relationship with one of China's top three meat processors," says Helen Hu Ying. "We've helped them move from basic

flavor extraction to a much broader application of enzyme processing to add more value to their meat coproducts. Novozymes provided in-depth technical support for this development process.

"It's fair to say that our customer has experienced significant growth in the past few years due to increased use of enzyme processing. Probably the best measure of the company's success in this area is that they have very ambitious plans to increase coproduct sales. They've set up a new department dedicated to expanding coproduct sales in China and to Europe, Japan, and Southeast Asia." ■



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INNOVATION AND – BAIT FOR NEW MARKETS



With last year's COP15 heightening global awareness of the need for a cleaner and more prosperous future, it is time to take pride in the existing innovative partnerships that Novozymes enjoys with sustainability-seeking customers. One such company is Marine Bioproducts AS, a Norwegian production and research company focusing on the gentle and natural processing of fresh raw materials of marine origin.

Marine Bioproducts' subsidiary Biomega specializes in the processing of salmonids based on a patented enzymatic hydrolysis process followed by separation steps that result in high-quality protein, lipid, and bone-derived products – all preserving the bountiful benefits offered by fish. Biomega's close relationship with Novozymes took root back in 1998 when Harald Hagen, CEO and Sales Manager, Marine Bioproducts, and Bent Piil Pedersen, Customer Solutions, Novozymes, first discussed how Novozymes' enzymes could help bring Harald Hagen's concept to life.

Fresh thinking for fish coproducts

Harald Hagen was working at a fish silage company when he first contemplated a cleaner and greener way to create higher-value products from fish coproducts. Fish silage is a liquid product made from whole fish or fish parts that are liquefied through the action of naturally occurring enzymes within the fish in the presence of added acid. The enzymes break down the fish proteins into smaller soluble units, and the acid speeds up their activity while preventing bacterial spoilage. Harald Hagen's idea – to convert the fish coproducts into high-quality oil and protein-derived products using enzymes as natural processing aids – was a far more sustainable option, but it was not applauded by the owners of the silage company.

Harald Hagen then shared his concept with Kjartan Sandnes, now Research & Development Manager at Marine Bioproducts, and Karstein Pedersen, now CFO and Chairman of the Board of Marine Bioproducts. Their hard work and determination, combined with Bent Piil Pedersen's know-how and Novozymes' enzymes, saw the development of exciting new fish products – and the establishment of Marine Bioproducts as a stand-alone company in 2000.

Friendly fish processing

According to the International Fishmeal and Fish Oil Organization (IFFO), 90 million tons of fish are caught per annum by fisheries throughout the

world, with 33% used as food, 33% as fishmeal, and the remainder classified as coproducts. In salmon processing, up to 50% of the weight of the complete catch ends up as coproducts; heads, backbones, skin, trimmings, and viscera. With the demand for salmon continuing to grow, so too are the quantities of resulting coproducts. So Marine Bioproducts' innovative alternative to fish silage not only means the development of a higher-value product, but also a new way to improve the sustainability of marine resources by maximizing the use of every fish caught.

"What is truly interesting about the way we process salmon coproducts is that there is absolutely no waste," explains Kjartan Sandnes. "We produce a protein-rich hydrolysate, a fresh, high-quality salmon oil, and all the remaining material

“Using enzyme solutions from Novozymes is what has helped us to process salmon in this new and extremely efficient way.”

Kjartan Sandnes, Research & Development Manager, Marine Bioproducts

is dried to make salmon meal that is used for pet food. Using enzyme solutions from Novozymes is what has helped us to process salmon in this new and extremely efficient way.”

Excellence through enzymes

The advantages of using enzymes in the production of salmon protein are significant – particularly when compared to traditional silage methods. "Enzymes such as Novozymes Protamex® or Novozymes Alcalase® offer a safer, cleaner, and more robust process," says Bent Piil Pedersen.

SUSTAINABILITY



The Novozymes' team enjoys the beautiful scenery at the Biomega processing plant in Skogsvåg, Norway.



"They're much easier to control and can operate under mild conditions. With enzymes, there's no risk of equipment corrosion."

The superior quality of Marine Bioproducts' offerings is undisputable. The hydrolysate is high in protein, well balanced, rich in marine amino acids, and low in fat and other unwanted products, making it a useful tool for upgrading proteins. The salmon oil is of premium quality and made from entirely natural, fresh raw materials. It is rich and rosy in color, an important characteristic of virgin salmon oil. The salmon meal can be upgraded using added hydrolysate to make a premium pet food. "Our products are unique, all being of food-grade standard," says Kjartan Sandnes. "Using enzymes really elevates the quality of our products and makes them stand out."

Forging a future with fish

The high-quality products derived from the salmon coproducts are impressive, and Marine Bioproducts believes there is even more potential yet to be released. "Our collaboration with Novozymes has always been excellent. Bent Piil Pedersen is always there to answer our every question," says Kjartan Sandnes. "We're look-

ing forward to innovating even further!" With a research and development plant currently open in Chile, Marine Bioproducts hopes to develop new ways to use its protein to fortify other foods.

Clinical studies in both Norway and the US are currently investigating the impact of fish protein on lipid metabolism in humans, the results of which could potentially open up some interesting new markets for the company. "There is untapped potential in Vietnam, an interesting location for us," says Kjartan Sandnes. "Pangasius, or catfish, is extensively farmed in the Mekong delta, resulting in 1 million tons of by-product.

There is no other place in the world with so much raw material in a concentrated location, so we're currently studying the chemical composition of this fish. Finding a new use for these coproducts would greatly enhance the sustainability of the Vietnamese fishing industry through maximizing the use of the catch."

Novozymes has already had some success in selling enzymes for fish processing in Asia. "Enzymes such as Alcalase have helped increase both the sustainability and profitability of the fish industry in my region," says Helen Hu Ying,

Regional Marketing Manager at Novozymes. "It's all about rethinking the way fish is processed to increase efficiency and convert the coproducts into valuable fish proteins."

Marine Bioproducts may still be a small company, but the news of its originality and unique products is beginning to spread. "We were one of three companies nominated for an 'Innovation Norge' award," says Ola Flesland, CEO of Biomega. "To be recognized as an innovator and a leading player in our field was a great achievement for us." With its continued focus on unleashing the potential of by-products and embracing healthy business and a healthy planet, the company seems certain to catch exciting new markets. ■



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DELIVERING ON OUR 2010 PROMISE



Over the last 10 years, research efforts within the biofuel industry have focused on developing a commercially viable way to produce ethanol made from the cellulosic material found in everything from corn cobs to municipal waste. Now, the world's ethanol industry can take a significant step forward thanks to the new Novozymes Cellic® CTec2 enzyme solution.

Biofuels made from sugar and starch feedstocks have long been an important component of the world's energy sources; however, the widespread availability and low cost of biomass residue make them a logical – and exciting – source of advanced biofuels. An increasing number of countries are working to capitalize on bioethanol's potential to lower greenhouse gas emissions, provide energy independence, and spur economic growth. Through performance-enhancing product developments and strategic partnerships, the enzymes needed to produce commercially viable cellulosic ethanol are now available.

Biofuels are a key source of sustainable energy. Transportation is responsible for a quarter of global energy-related CO₂ emissions (and this figure is steadily rising), and biofuel is the only existing renewable energy source for transportation that can effectively lead the world toward a low-carbon future. Cellulosic ethanol can reduce CO₂ emissions by up to 90% compared to conventional gasoline, a goal that many nations recognize as worth pursuing. The potential of this growing

industry for meeting the demand for an alternative global liquid transport fuel is so well accepted that the US is requiring 16 billion gallons of cellulosic ethanol production by 2022, with other governments enacting similar mandates.

No longer “just around the corner”

“We made a promise to deliver commercially viable enzymes by 2010, and with the launch of Cellic CTec2, we have delivered,” says Cynthia Bryant, Global Biomass Business Development Manager at Novozymes. “But it's not just about developing better-performing, lower-cost enzymes. We also bring extensive internal research to our collaborations that result in developing a successful process our partners can use to manufacture and sell cellulosic ethanol.”

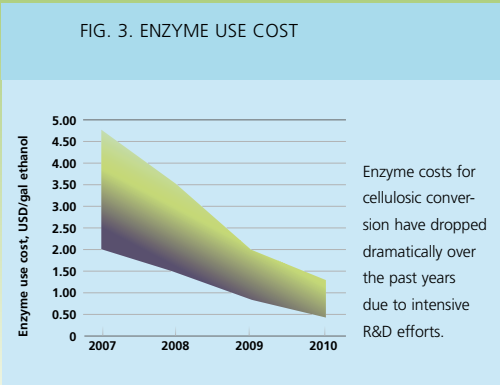
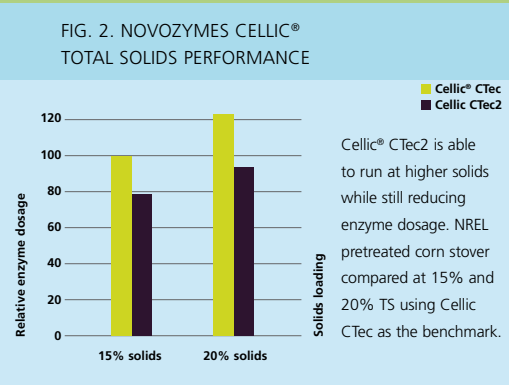
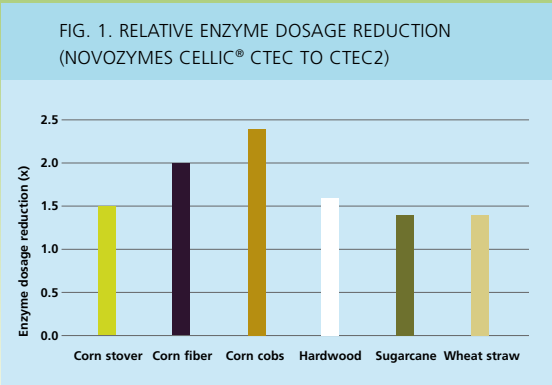
Cellic CTec2 is a novel cellulase complex that provides state-of-the-art cellulose conversion and the unmatched cost performance needed to take cellulosic ethanol to a commercial scale. Compared to Cellic CTec, launched in 2009, test results show a significant performance improve-

ment across a range of feedstocks and process technologies when measuring glucose formation under relevant hydrolysis conditions (see Fig. 1).

Mads Torry-Smith, R&D Manager at Novozymes, explains: “Cellic CTec2 has been designed to provide maximum robustness toward feedstock and process variation. High levels of beta-glucosidase ensure continuous production of fermentable sugars. Research with our partner pilot plants over the past year has resulted in further process optimization that takes full advantage of this new enzyme system and allows for operation under commercially relevant conditions.”

To measure the performance increase, a variety of pretreated substrates were processed using both versions of the Cellic enzyme. Not only does the Cellic CTec2 enzyme complex deliver better performance improvement overall, but it provides an even greater performance benefit than Cellic CTec at higher total solids (TS) (see Fig. 2). Higher TS conditions permit processing of more cellulose and hemicellulose, resulting in higher ethanol titers and reduced capital and operating costs.

FOR CELLULOSIC ETHANOL



The potential of cellulosic ethanol

The world's energy consumption is increasing, carbon emissions are having a visible effect on climate change, and usable oil reserves are diminishing. Clearly, one of our biggest challenges is the need for viable alternatives to petroleum-based energy sources. Novozymes has long been supplying enzymes for starch-based ethanol, recognizing that biofuels provide an answer to the search for a renewable and sustainable fuel.

Cellulosic ethanol – biofuel produced from feedstocks containing cellulosic biomass – is the most promising new contributor to the biofuel solution. The raw materials are many and varied, but there have been key technical and economic challenges in the quest to bring cellulosic ethanol to market. Despite the abundance of viable feedstocks, these substances are complex and can be

difficult to break down and convert into ethanol. While traditional sugar- and starch-based processes rely on a few key crops and standardized technology, cellulosic ethanol production is much more complex.

High enzyme costs for the cellulosic process have been one of the biggest challenges. As a result, Novozymes has focused on how best to manage process integration and optimization while balancing capital and operating costs. Ten years ago, Novozymes was awarded US Department of Energy (DOE) funding to conduct extensive research and development on enzymatic cellulosic ethanol conversion. At the time, the cost of enzyme application for cellulosic feedstocks was too high, and few thought that it was possible to come up with a commercially viable process.

Powerful partnerships

Since 2000, Novozymes has consistently reduced enzyme costs, fueling excitement and promise in the future of cellulosic biofuels (see Fig. 3). Still, in order to achieve truly significant cost reductions, a more holistic approach was required. All aspects of the production process – from feedstock transport via pretreatment to operating expenses – had to be examined and improved. This realization of the need to combine better enzymes and process efficiencies has led to unprecedented endeavors toward both internal research efforts and valuable partnerships around the globe.

“A key component of Novozymes’ approach is developing strategic partnerships within the cellulosic ethanol industry. We recognize that it will take many different feedstocks and processes for cellulosic ethanol to reach its full potential. We have thus chosen to collaborate with a number of industry leaders in order to enable as many technologies as possible,” says Cynthia Bryant. “This has allowed us greater insight into the cellulosic conversion work currently underway across the

globe – insight which we use in our continuing research and the development of enzymes and process improvements. We have achieved significant results in lab and pilot project work with many of our partners, including POET, Greenfield Ethanol, Inbicon, Lignol, ICM, and COFCO.”

Novozymes and its partners joined forces in order to capitalize on their different competencies. Understanding that the relationship between process mechanics and enzymes is critical, it was important to design processes that provide a suitable environment for the enzymes to do their job effectively. As a result, several of these collaborations have begun to achieve success through the reduction of process capital and operating costs, which has led to accelerated technical and commercial developments. When process improvements and new enzyme technology are combined, these partnerships have been instrumental in making the commercial viability of cellulosic biofuel a reality.

There is much excitement that Cellic CTEc2 is now globally available in commercial-scale volumes. With its proven performance, Novozymes has delivered on our promise of a commercially viable enzyme product in 2010. With the launch of our latest Cellic products, cellulosic ethanol is no longer “just around the corner” – it’s here now! ■



With Novozymes Cellic® CTEc2, it is now possible to produce ethanol from the cellulosic material found in everything from corn cobs to municipal waste.

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ELEMENTAL TEXTILES FOR A SUSTAINABLE

As the sustainability wave continues to sweep across businesses, we are faced with the fact that this is not a case of “here today, gone tomorrow,” but a concept that is becoming increasingly integrated with business practice. At Novozymes, this progress is welcomed as we have always been committed to developing sustainable enzymatic solutions for forward-thinking companies – and the textile industry is no exception.



Elemental textiles sustain the water streams by reducing water usage and making wastewater cleaner.

Although washing and drying clothes may consume a lot of energy and water, there are many sustainable contributions to be made in the textile industry even before the clothes reach the consumer. Bioinnovation from Novozymes can already enable the relevant processes, but the solutions are often used as stand-alone products. So, in order to get manufacturers to use nature’s own enzymes in all of their processes, Novozymes joined forces with global textile and apparel manufacturer Esquel Group to demonstrate the impact of today’s enzyme technology. This was done by applying bioinnovative solutions at all the different stages of the production of one T-shirt.

Enzymatic solutions are elemental

Teaming up with Esquel meant sharing knowledge and R&D competencies to make trials work optimally. The trials were performed at Esquel’s facilities using the best available technology for knitted fabric: bioinnovation and chemicals. First,

the fabric was bioscoured and bleached at low temperature. Next came the dyeing process, in which Novozymes Cellusoft® Combi, which removes residual hydrogen peroxide and then bioblends fabrics, was applied. The trials finished with a bio-soaping of the fabric using an enzymatic rinse solution. As a result, Novozymes produced what was coined “the elemental T-shirt,” a showcase for the overall “elemental textiles” concept.

Amazingly, the life cycle assessment conducted by Novozymes indicates possible savings of 70,000 liters of water and 1 ton of CO₂ per ton knitted fabric. It also shows a 20–25% reduction in processing time. “The savings we have achieved almost took us by surprise! We’re very glad to see that our solutions can reduce water and energy usage to such an extent simply by being applied at different stages of the same textile production process,” says Han Kuilderd, Customer Solutions Manager at Novozymes.

Creating textiles using the best technology available is elemental because it is cost neutral, it achieves greater quality, and the solution helps to protect the four elements:

- Water: Elemental textiles save water and make wastewater more environmentally friendly
- Air: Elemental textiles reduce emissions of CO₂ and other damaging particles
- Fire: Elemental textiles lower energy consumption and the use of fossil fuels
- Earth: Elemental textiles get you more fabric from your crops and reduce overall usage of farmland

When we consider that 9 million tons of knitwear is produced every year, it is easy to imagine the difference that elemental textiles could make in the textile industry. That is why the elemental T-shirt is just the beginning. “We believe that mills and retailers can go a long way with elemental textiles. Savings in time seasoned with increased

TEXTILE INDUSTRY



ESQUEL GROUP

Novozymes' sustainable elemental textiles solutions do not compromise on quality.

output and better quality at the same cost as a traditional process give a competitive edge, and, considering the sustainable aspect, it's a win-win situation for everyone," explains Umar Riaz, Global Marketing Manager at Novozymes. With elemental textiles Novozymes plans to collaborate with world-leading textile companies to bring about an industry that, by using enzymes, keeps customers, producers, and the environment happy.

Bioinnovation paves the way

Substituting chemicals with enzymatic solutions throughout the process does not affect quality – that is something on which enzymes do not compromise. Novozymes therefore sees great potential in elemental textiles, which we believe will pave the way for a more sustainable textile industry. Taking a step in the right direction, elemental textiles were featured at the Fashion Summit in Copenhagen in December

2009. The summit was a side event to COP15, and it drew over 600 eco-conscious fashionistas from around the world to kick-start the Nordic Initiative Clean and Ethical (NICE). Hosted by the Nordic Fashion Association and the Danish Fashion Institute, the Fashion Summit turned the spotlight on accelerating sustainability and socially responsible behavior in the dynamic and fast-to-market fashion industry. A proud partner, Novozymes and the elemental textiles exhibition received a lot of positive attention from the media and retailers.

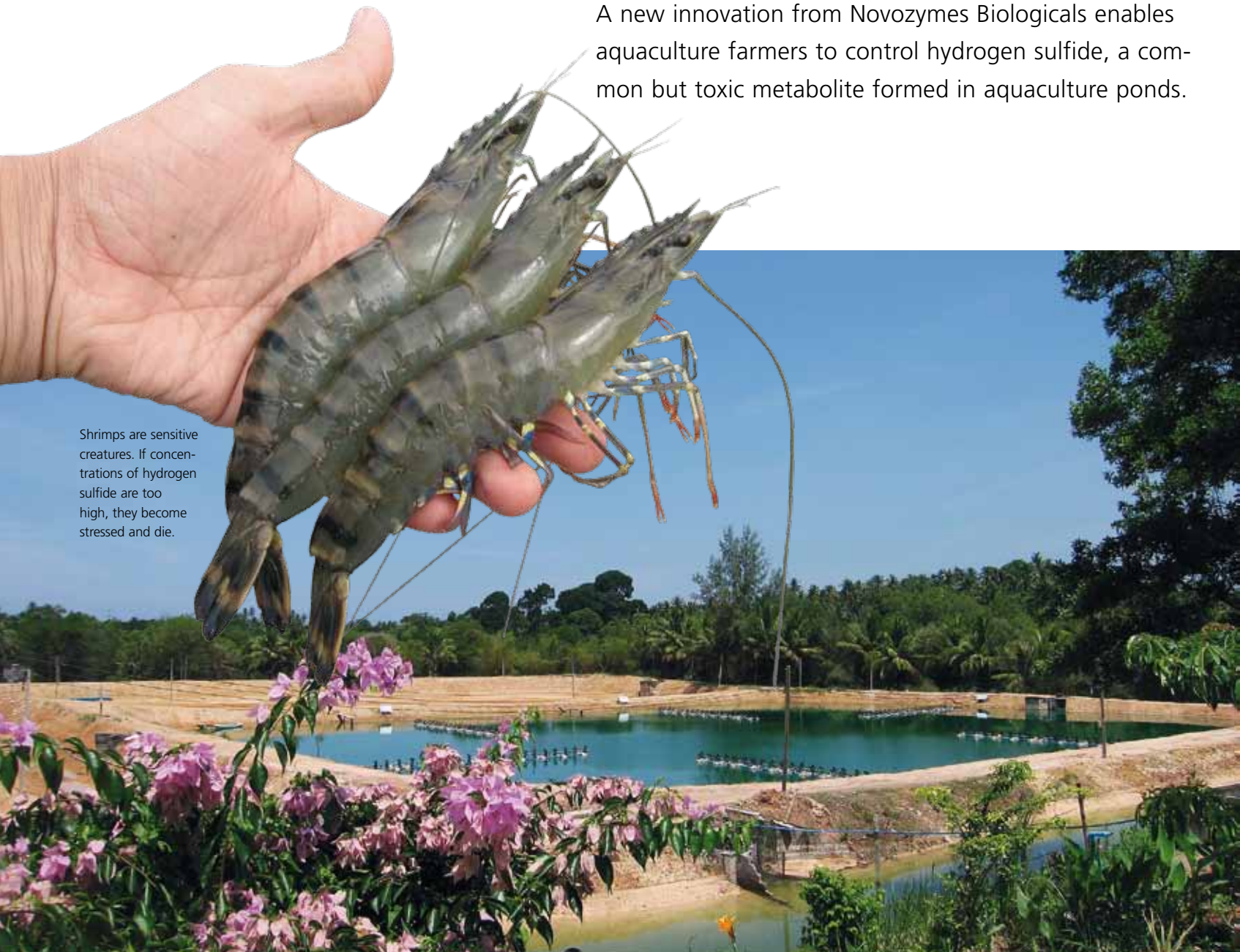
Novozymes' collaboration with Esquel to develop the elemental textiles concept shows that rethinking conventional processes and incorporating sustainable ones instead is actually good business because it leads to reduced manufacturing costs, increased competitiveness, and higher-quality fabrics. That is why turning your business elemental makes perfect sense. ■

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NATURAL SOLUTIONS FOR MORE SUSTAINABLE

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.

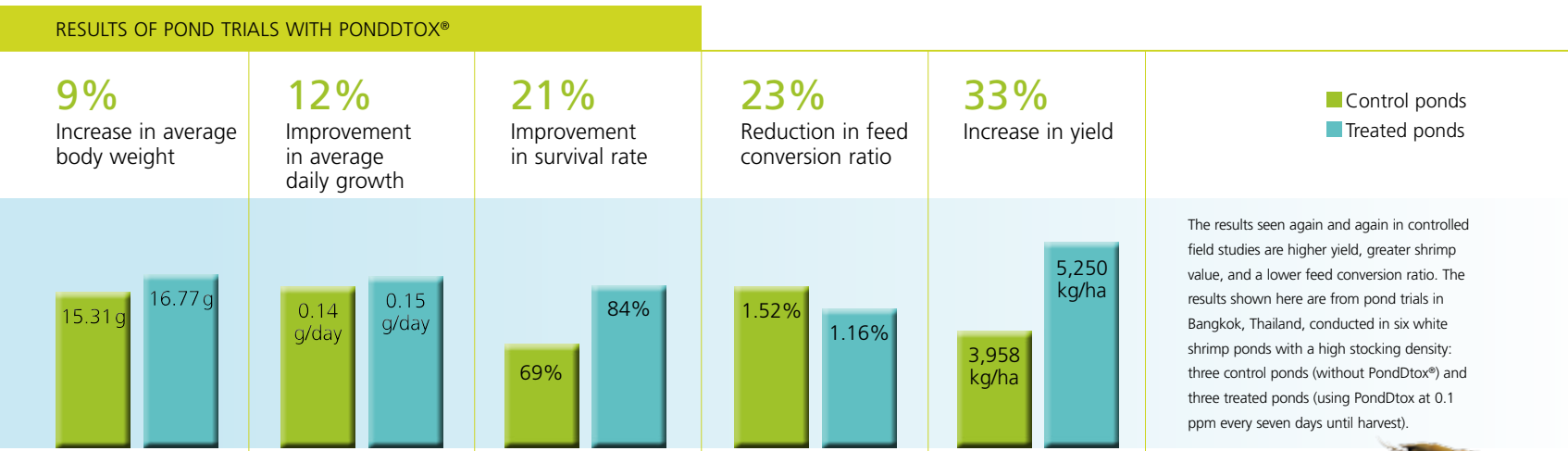
Untreated effluent water from aquaculture facilities is also highlighted as a major environmental concern where the farms are located. The nutrient-rich effluent water can cause eutrophication (algae blooms), which is devastating to an aquatic system as it causes oxygen depletion. In addition, toxins 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

SUSTAINABLE AQUACULTURE



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



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 were 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. ■

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MORE THAN A HUNDRED ONLINE ARTICLES

All the articles in this issue are available online at www.biotimes.com. An easy search by issue or by industry will lead you to other relevant articles.

ATTENTION! ADDITIONAL DETERGENT ARTICLE EXCLUSIVELY ONLINE

VISIT THE MARCH ISSUE AT www.biotimes.com to find an article about the Detergent Sustainability Summit in Copenhagen.



Although no binding agreement was reached at COP15, the political support for greener industry is evident. Executive Vice President Peder Holk Nielsen reflects on the outcome.

A GREENER POLITICAL AGENDA

Copenhagen was in a fever of excitement hosting the UN Climate Conference, COP15, in December 2009. Heads of state flocked to Denmark to take part in the conference, aiming to reach an agreement on global climate change.

The week-long intense negotiations did not result in a legally binding treaty, but "only" the Copenhagen Accord. The fact that the leaders of the world's major economies could agree on the Accord is certainly a significant step forward, reflecting a broad global political willingness to combat climate change, but it was not what Novozymes had hoped for. Had the leaders instead been able to agree on pricing carbon pollution, for instance, this would have completely shifted the focus of climate change measures to nonpolluting renewable solutions like ours, bequeathing a greener planet to our children and grandchildren into the bargain.

Novozymes at COP15

Being the world leader in bioinnovation, Novozymes used the unique opportunity COP15 offered to meet with key stakeholders such as politicians, decision-makers, and NGOs, and to extend their knowledge of white biotechnology at different levels with varied examples of how our biosolutions make it possible to produce more from less, reduce energy input, reduce waste generation, and use renewable raw materials instead.

One of the more striking and pioneering aspects of COP15 was that half of the conference's official VIP vehicle fleet was fueled using a new and advanced, environmentally friendly biofuel produced from straw using Novozymes' enzymes. It was probably the world's first filling-

up on this scale with biofuel made from straw, achieving an amazing 85% reduction in CO₂ emissions.

Enzymes for advanced biofuel

Novozymes has promised to deliver commercially viable enzymes for advanced biofuel production in 2010. When President Obama said in his speech at COP15 that the US is convinced that changing the way they produce and use energy is essential to the country's economic future – that this will create millions of new jobs, power new industry, keep them competitive, and spark new innovation – it was an affirmation of our decision to build a new manufacturing facility in Blair, Nebraska.

In January, the Obama Administration showed Novozymes its continued support by granting an Advanced Energy Manufacturing Tax Credit for the construction of the new facility in Nebraska. The facility qualifies for the tax credit program by producing enzymes for advanced biofuels – clean energy – and by creating more than 100 green jobs for the state.

The future

This year, the 16th Conference of Parties (COP16) will take place in Mexico. Whether or not a legally binding treaty is reached this time, Novozymes will continue the dialog we have started with key influencers and keep reminding them of the greener alternatives – the Novozymes alternatives. ■

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