TO OUR READERS

In this special edition of Biotimes, we focus on the advancements enzymes deliver to the leather industry and how these technologies improve our customers’ businesses. At Novozymes, we excel at developing unusual enzymatic tools which can add value to your products and processes. By using sustainable solutions, we can improve your leather processing so there is less environmental impact and preserve nature’s scarce resources for the future. We call this innovative approach “Rethinking Tomorrow.”

These articles are from previous issues of BioTimes, so there may be some changes regarding people and the companies they work for. However, the benefits offered by our enzymes remain the same.

Fat removal is a significant challenge for leather tanners across the world. Pressing, solvent extraction, and washing with surfactants are all classic ways of treating leather. However, these traditional means present potentially great risks to facilities, personnel, and the environment. Novozymes offers tanners an alternative way to remove fat effectively and easily without all the risks.

We have engineered a series of lipases which reduce fat content to less than 5% in both acidic and alkaline conditions. By using lipases, tanners can avoid added investment in dry cleaning equipment. They can also curb their use of dangerous chemicals which compromise the quality and strength of the final garment. Read “Beyond Bating” on page 3 to learn more about our fat removal solutions, Greases(r) Ultra and NovoCor(r) AD L. The article on page 4 illustrates how these products have inspired our customers to rethink their fat removal approach and improve their leather quality.

Discussions about industrial processes naturally lead to tough questions concerning environmental impact. At Novozymes, we welcome these challenges because our enzymatic solutions not only improve business profitability -- they are inherently gentle on the environment.

Enzymes can be used at various stages of leather production. Replacing commonly-used harsh chemicals with enzymes during soaking and unhairing results in energy savings from reduced processing times. Additionally, using an enzymatic application for unhairing allows a tannery to reduce sulfide usage, thus producing cleaner wastewater. Read more about the Life Cycle Assessment comparing chemical and enzyme-assisted soak and liming performed with a Chinese tannery on page 6. The conclusions support claims that enzymes are the natural solution for improving leather production in a sustainable manner.

The leather industry has come a long way in applying new technologies to many leather making processes including fat removal. At Novozymes, we have demonstrated that our state-of-the-art lipase solutions provide a greater benefit to the tanner than traditional means that require harsh chemicals. Treating leather with enzymes shortens processing time, reduces water consumption, and decreases use of toxic chemicals while simultaneously improving the quality of the final leather. These BioTimes articles illustrate how and where enzymes can be applied to leather processing and give real-world examples of how your bottom line and the environment can benefit.

We are rethinking tomorrow and look forward to sharing our innovations with you.

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**BEYOND BATING**

Most tanners only think of enzymes for bating – the use of proteases to soften leather. However, in the future, a new class of enzymes will be used increasingly in tanneries – lipases for the removal of fat.

Fat is a challenging component of leather for tanneries. When processing small skins from goats and sheep, tanneries aim for a residual fat content of no more than 5%, but they are not always able to achieve this. The problem is that the fat is embedded between the grain surface and the corium (the deep inner layer of the skin). This makes it very hard to remove. That’s why dry cleaning with strong solvents is a widely used technique. However, dry cleaning is expensive and the results are not optimal due to possible damage to the skins.

Surfactants are a milder and safer chemical alternative but not as effective. Yet another method developed by Novozymes is lipases – fat-degrading enzymes that can simply be added to the drums.

**Leader in lipases**

Novozymes is a leader in lipases. The original Greasex® for degreasing in tanneries has been around since 1991 but it has just been improved with the development of a completely new enzyme molecule called Greasex Ultra.

There is great potential for lipases. Unlike proteases, there is no worry of hide damage if something goes wrong. Lipases cannot degrade protein so there are many benefits but no associated risks. The benefits include increased uniformity and chemical uptake. Lipases improve filling and dye penetration to produce a much more uniform appearance. There are special benefits from using lipases to replace surfactants in the making of waterproof leather and automotive leather.

Lipases can be used to disperse natural fat in all stages of leather production: soaking, liming/bating, pickling, wetblue, or natural crust/dyed crust. On the following pages, case studies from two of the leading tanneries in Pakistan show how lipases are used to treat small skins.

**Hair removal**

Lipases are growing in popularity, not just for small skins but for hides, too.

Residual hair on hides is a major problem today in the leather industry due to lack of penetration of unhairing chemicals. Natural fat is the biggest barrier to the dispersion of these chemicals. Reducing fat leads to easier hair removal.

What makes Novozymes’ new lipase Greasex Ultra different from the original Greasex is that it is more effective at removing the sebaceous grease, namely the grease at the root of the hair (see photos). It is also very effective at hydrolyzing the subcutaneous fat. In general, Greasex Ultra gives more consistent hydrolysis when used at equivalent concentrations, possibly thanks to better diffusion of the enzymes into the fat cells.

In the near future, tanners will come to use lipases on a daily basis. In 30 years, tanning will be a combination of biotechnology and environmentally friendly chemistry.”

Lars Rasmussen, Global Customer Solutions Manager for the leather industry at Novozymes

"Fig. 1. Control sample."

"Fig. 2. Treated with 0.1% surfactants during bating."

"Fig. 3. Treated with 0.1% Greasex Ultra during bating."

**SPOT THE FAT!**

These micrographs show a cross-section of bovine hide magnified 10 times. The fat has been dyed red after bating to highlight it. Figure 1 shows the control sample of bovine hide treated without enzymes or surfactants, and Figure 2 shows the sample treated with surfactants. It is apparent how much more residual fat there is in these two samples compared to the sample treated with Greasex® Ultra (Figure 3) where the sebaceous glands on the surface are almost empty. The research was done by the British Leather Confederation.

FOR MORE INFORMATION

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Leather

Irfan Iqbal (right), CEO of Nova Leathers, and Umar Ijaz, Country Business Manager for Novozymes in Pakistan, examine the finished leather. Fatty spews are no longer a problem.

Nova Leathers in Karachi is the largest tannery in Pakistan. Each month, they process 2.5–3 million sq.ft (230,000-280,000 sq.m) of leather and produce 75,000-80,000 leather garments. This is a high-volume producer with a high throughput and some high-profile customers. The garments are sold through major retailers in Europe and around the world such as the Inditex group, one of the world’s largest fashion distributors.

Spews mean spots

The company makes leather almost entirely from imported sheepskins and goatskins. About 70% of the skins are wetblues whereas the rest are natural crust leather. Until 2006, Nova Leathers purchased most of their skins locally or from Africa. The fat content of these skins was quite low (around 10%) due to environmental conditions. However, following a dramatic reduction in the price of skins from Europe, Russia and the Middle East in 2006, Nova Leathers began buying more skins from these areas. The fat content was much higher, causing problems of fatty spews in the final garments. A spew results from a residual fat deposit inside the leather. Depending on the temperature conditions, the fat can migrate to the surface after a few months. Fatty spews are white greasy spots on the surface and they are unpleasant to smell and touch.

Expensive to dry clean

A well known way of reducing the fat content is dry cleaning. Nova Leathers had three dry cleaning machines at the tannery, each with a capacity of treating 500 skins per day. “With our throughput, we would have needed to buy about 100 machines to dry clean all the skins. It would work out to be extremely expensive. Tumbling in these machines also reduces the area by 3-4% and can damage the leather by making it loose. More dye is needed as well. Dry cleaning was just out of the question for us,” comments Irfan Iqbal, the CEO of Nova Leathers (pvt) Ltd.

The tannery also tried using two different types of surfactants but the results were not satisfactory.

Acid lipase to the rescue

In 2006, Nova Leathers contacted Novozymes in Pakistan and asked them if they had any solution for fatty spews. The answer was lipases. Under the guidance of Novozymes, they began to test lipases in both small trials and bulk production batches with sheepskins. They tried the unique acid lipase NovoCor ADL designed for degreasing in acidic conditions of pH 3.5-4.5 typical for pickled skin or for wetblues. In the case of crust leather, Greasex® 50 L was recommended because

NOTHING WORKED LIKE NOVOCOR® AD L FOR NOVA LEATHERS

After receiving complaints from international buyers about fatty spews on their garments, Nova Leathers tried various methods to avoid these unpleasant spots. The lipase NovoCor ADL was the only practical alternative.
Nova Leathers does not just process the leather but also cuts and stitches it into garments, gloves, and bags.

**KHAS INDUSTRIES FIRST WITH ULTRA**

Greasex Ultra consistently reduces residual fat levels to less than 5% in sheepskins and goatskins at Khas Industries, the first tannery to try this new lipase.

The Khas Group is one of Pakistan's largest tannery groups with five tanneries producing 1-2 million sq.ft (90,000-180,000 sq.m) of leather per month.

As part of a close co-operation with Novozymes, Khas Industries in Karachi became the first tannery in the world to try Greasex Ultra in February 2007. The enzyme was tested here before the worldwide launch a few months later.

Khas Industries produces garment leather for clothes and gloves, mainly from small skins in the form of dry crust leather. Soon after the trial, the tannery began to use Greasex Ultra on a regular basis to remove excessive fat and for soaking. Fat has become a growing problem for Khas as imports have grown. In contrast to the lean sheepskins and goatskins from Pakistan, the imported skins often contain 25-35% fat.

Greasex Ultra is used in the soaking process for dry salted goatskins from Africa that are difficult to wet back. An excellent wetting effect is achieved by the combination of the protease NovoCor® S 2500 and Greasex Ultra.

The new lipase is also used together with surfactants for the effective degreasing of depickled sheepskins. Before trying Greasex Ultra, surfactants were used on their own for degreasing but the results were not satisfactory. After treatment with Greasex Ultra, the content of residual fats is consistently below 5% with the fat evenly dispersed.

“A trendsetter”
Degreasing is just one example of the use of enzymes at the tannery. Khas Industries uses no less than five different enzymes.

“Khas Industries uses more or less our whole product portfolio,” comments Arshad Gazi, Customer Solutions Manager at Novozymes for the leather industry in Pakistan. “The CEO there, Mr Massood, is a trendsetter. He has a different mindset based on careful control of the enzymatic processes. There is a lot to be gained by substituting harsh chemicals with environmentally friendly enzymes. You are doing yourself a favor and you are doing the world a favor.”

Umar Riaz, who runs the Novozymes’ office in Pakistan, adds: “The thinking at Khas is quite different from many other tanneries in Pakistan, who are conservative and believe that enzymes can damage leather. In contrast, Khas sees enzymes very positively and is very innovative.”

With two of the largest tanneries in Pakistan – both the Khas Group and Nova Leathers – now using lipases, Umar believes that many of the other 2,000 tanneries in Pakistan may soon follow their lead.
Enzymes have been used in the tanning industry for centuries because they are efficient at degrading protein and fat. In early times, the enzymes were derived from animal excrement, and later on from the pancreas of cattle. Nowadays, many of the enzymes are produced using microbial fermentation, and Novozymes is a major supplier of this type of enzyme.

One of the applications of microbial enzymes in the tanning industry is in soaking and unhairing processes. Enzymes can replace chemicals and shorten processing times, thereby reducing production costs. Other benefits can include increased area yield and improved quality of the final product.

As part of Novozymes’ work with Life Cycle Assessment (LCA), the company collaborated with a Chinese tannery to assess the environmental implications of the application of enzymes in the soaking and unhairing of bovine hides.

**True production data**
The assessment is basically a comparison between two different ways of soaking and unhairing/liming bovine hides. An entirely chemical method was compared to an enzymatic method with reduced chemical consumption.

Life Cycle Assessment has been used as an environmental analytical tool to evaluate the changes in enzyme and chemical consumption that occur when switching from the chemical method to the enzyme-assisted method. The information has been derived from a major Chinese tannery that applies chemical as well as enzyme-assisted production methods.

The study was based as far as possible on true production records and refers to an enzymatic hair-saving process - where the hairs on the hides are not dissolved by the chemicals but removed intact.

The enzymes Greasex® 50 L and NovoCor® SG were used by the tannery for soaking to degrade fat and proteins. They reduced the soaking time, which leads to electricity savings in turning the drum. There were also savings in the tenside and soda requirements for the process.

The unhairing enzyme NUE 0.6 MPX was used to degrade proteins. It reduced the sulphide requirements for the process but did not influence processing time or temperature. The lower level of sulphides required reduces the sulphide...
content of the wastewater and some manganese sulphide can be saved.

**Savings in chemicals**

Savings in chemicals as a result of the enzyme application are shown in Figure 1. As can be seen, a relatively small quantity of enzymes replaces quite a large quantity of chemicals. The environmental impacts of producing and delivering the enzymes to the tannery on the one hand and savings in chemicals and electricity on the other hand have been evaluated and the results in terms of energy consumption and contribution to global warming are shown in Figure 2.

Figure 2 shows that a small ‘investment’ in energy and carbon dioxide emissions in enzyme production results in considerable savings when these enzyme products are used to replace chemicals and electricity in the soaking and unhairing/liming processes. Small amounts of enzyme products made from a biological production process replace a relatively large amount of harsh chemicals made using a relatively large amount of energy derived mainly from coal.

Contributions to other environmental impacts (acidification, nutrient enrichment and smog formation) are also reduced. In fact, the environmental impacts resulting from enzyme production are at least 20 times lower than the impacts that are avoided by the savings in chemical and electricity consumption.

Sulphide savings in the unhairing/liming process are considerable compared with other chemicals. Since a large quantity of coal is used to produce sulphides and a large quantity of carbon dioxide is emitted during production, the savings in sulphides turn out to be the most important environmental effect of enzyme use (see Table 1).

A comparison of conventional and enzyme-assisted bovine soaking and unhairing/liming processes indicates that the application of enzymes in the tanning industry results in considerable reductions in the contribution to global warming. The environmental advantages of enzyme application are primarily due to savings in sulphides and a large quantity of carbon dioxide during production, the savings in sulphides turn out to be the most important environmental effect of enzyme use (see Table 1).

Table 1 shows that new, more efficient enzymes will be able to virtually replace conventional chemicals in the soaking and unhairing processes.

**Global impact**

The global supply of bovine hides for leather production was about 8.8 million tons in 2005. Today, less than 10% of bovine hides are soaked and unhaired in enzyme-assisted processes. Assuming that the environmental improvements observed in this study by switching from conventional to enzyme-assisted soaking and unhairing/liming are applicable worldwide, the global potential saving is in the order of 8 million GJ of energy and 0.7 million tons of carbon dioxide per year. The saved carbon dioxide emissions are equivalent to the annual load from 75,000 average world citizens or 170,000 cars.

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**Principle of Life Cycle Assessment (LCA)**

LCA is a holistic environmental assessment tool which addresses raw material uses and emissions in all processes in the product chain from raw material extraction through production to use and final disposal. See www.howproductsimpact.net for a quick introduction to the LCA concept.
Gentle action with new NovoBate® enzymes

Pancreatic trypsin still dominates the bating market in the leather industry but now Novozymes is challenging this traditional animal bate with two newly developed microbial enzymes.

The bating process renders leather soft and pliable. For example, glove leather is highly bated whereas shoe sole leather is not bated at all. Traditional trypsin, a proteolytic enzyme extracted from the pancreas of animals, still dominates the bating enzyme market. The alternative is microbial enzymes made by fermentation and Novozymes is a leading supplier of these types of enzyme to the leather industry.

For many years, Pyrase® has been the major microbial enzyme sold for bating by Novozymes. However, Pyrase is not suitable for all bating applications due to the inherent nature of the skins, especially goat, and for leathers like floaters that require a more uniform grain pattern.

In future, Pyrase will continue to be sold for special applications, but in addition Novozymes is introducing two far more gentle and versatile enzymes for bating. The mildest is NovoBate 115 whereas new NovoBate 100 has been developed for a slightly speedier and more powerful bating effect. The new NovoBate products can be used to bate any type of hide or skin and they result in high-quality leather with a firm and delicate grain and they also give excellent scud loosening.

Safety issue

One of the advantages of microbial enzymes over trypsin is that they do not originate from an animal source and there is therefore no need for a health certificate. There is a risk of infection when animal bates are being handled in a tannery. Unless they are sterilised, the bates may contain pathogenic bacteria.

There is also a risk of cross-infection if tannery workers inadvertently take home traces of the bates on their clothing and then come into contact with livestock.

Another advantage is that microbial enzymes have a highly standardised activity that improves the quality of the final formulation.

Trial results

The effect of NovoBate 115 was tested in a series of trials performed in collaboration with the famous Reutlingen Leather Research Institute in Germany. The enzyme was applied in a standard bating process (100% fresh, pH 8.8-8.5, 30°C for 45 minutes) compared to a bating process using a standard pancreatic trypsin product on bovine pelt for shoe uppers.

The figure shows the scores relative to those obtained by using the standard pancreatic bating enzyme. The new microbial enzyme is comparable in performance to trypsin at a dose rate of 22,000 MTU per kg of pelt and gives an even better bating performance at higher doses.

Arranging a trial

Tanneries are invited to test the two new approved bating enzymes that were first launched in June 2006 and are currently being used by a number of tanneries. Novozymes recommends using a prolonged bating process at normal bating pH and temperature in order to achieve a complete reaction, i.e. 60 to 90 minutes for tighter leathers and 120 minutes or longer for soft articles. With the new bating concept from Novozymes, a real bating effect can be obtained on all leathers.

Novozymes’ Customer Solutions experts around the world or local formulators can be on hand to offer technical support for a trial. They can advise on the optimal dosage and reaction time because the dosage is highly dependent on the raw material and the article to be produced. A good trial result will convince tanners that there is a viable and safe alternative to trypsin.

Advantages of the new enzymes

✓ Mild and gentle bating
✓ Excellent scud loosening
✓ Fine and delicate grain
✓ High-quality leather

Three kinds of evaluation were made:

- Bating effect (scud removal, float colour, thumb mark, etc.)
- DIN tests (lastometer, tear strength, tensile strength and elongation at break)
- General leather quality of crust (grain quality, colour uniformity, softness)

A similar bating effect was achieved with a dosage of approximately 22,000 MTU per kg of pelt. A higher dosage may improve the bating process without damaging the quality of the final leather.
The fears of tanners

Traditional tanners often view enzymes with suspicion. They worry that new enzyme technology may eat up their leather but how real are these fears?

Considering that the use of industrial enzymes for the tanning of leather in the 1930s was one of the earliest applications of enzymes, enzyme technology has made surprisingly slow progress in the leather industry. Today, when other industries based on traditional handicrafts such as wine-making and brewing have accepted the use of enzymes, most tanners remain sceptical.

“It is the fear factor,” says Lars Rasmussen, technical manager for the leather industry at Novozymes. He himself is an ex-tanner with tanning experience from his native Denmark, Germany and Latin America, so he knows what he is talking about.

What can enzymes do?

“It requires a lot of hands-on help to convince tanners about enzymes,” he continues. “In many cases, no one has taken the time to inform tanners about what enzymes can do. Therefore I arrange demonstration trials at their tanneries and when they see the results, they suddenly start to use enzymes for the first time.”

Lars Rasmussen is a regular visitor to China and India, accounting for 75% of world leather production. He has also spent time promoting enzymes in Australia and New Zealand. According to Lars, China is the country most open to new enzyme technology.

Only degrades grease

Dennis Thams is CEO of Shanghai Richina Leather, China’s second largest tannery, and a Novozymes customer. He has been one of the first to try innovative enzymes from Novozymes (see www.novozymes.com/biotimes).

“I started as a leather technician and I have 38 years experience in the business,” he says. “Enzyme technology is something I’ve kept a watchful eye on for most of those years. The use of enzymes was pretty disastrous in the early years but, these days, with the development and the specificity of the enzymes, they are starting to become a reality.”

Dennis Thams gives the example of degreasing with Greasex®, a lipase from Novozymes:

“The alkaline removal of grease with the enzyme Greasex at the soaking stage is not widely used in the industry. It is really only just becoming established. In normal circumstances, the use of enzymes at the soaking stage raises big issues of grain degradation. Will they actually attack the protein itself? However, this enzyme does not act on the protein molecules so it does not interfere with the quality. Greasex has certainly worked well for us. The results are a flatter and cleaner hide with better dyeing.”

Unharing enzyme

In 2002, the Shanghai tannery started using another innovative enzyme from Novozymes for the unhairing of hides called NUE.

This enzyme is a protease used on the raw hides at the liming stage. Liming is characterized by a high pH of 12.5 at which the activity of most enzymes decreases. NUE is different because it goes on working. NUE is a potent protease and many tanners fear that it may eat up their pelts. However, NUE is not a general digester of protein. It only attacks certain key proteins to open up the hide.

But what happens if too much NUE is added by mistake? Tests at the British Leather Confederation showed that 10 to 20 times the recommended dose has to be added before any grain damage occurs. After a few hours, the residual activity of NUE is low and that’s another safety feature.

Tanning is changing

From being an old artisan craft, modern leather-making is becoming more of a chemical process. In future, enzymes will feature even more in the process.

“I try to make tanners understand that something has changed,” Lars Rasmussen comments. “Biotechnology is bringing a new dimension to tanning.”

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Pakistan’s tanneries see benefits of new enzyme technology

With 48 million goats and 25 million sheep in the country, the leather industry in Pakistan is big business. In partnership with distributor Hostachem, Novozymes is bringing new enzymatic technology to Pakistan’s tanneries, resulting in higher-quality leather goods and less environmental pollution.

On the face of it, you might not expect Pakistan to boast a large leather industry. In a country where daytime summer temperatures remain stubbornly above 40°C, the domestic market for leather coats and jackets is understandably rather small. However, the leather industry in Pakistan is actually worth more than USD 700 million, with the vast majority of goods being shipped overseas to the European Union and the United States. There are around two thousand tanneries in Pakistan driving this market. According to Umar Riaz, Novozymes’ country business manager for Pakistan, around 450 of these are large integrated tanneries producing both wet blues (half-finished skins and hides that require further processing) and finished garments.

“Pakistan’s tanneries are exporting finished garments such as coats, jackets, gloves and uppers for shoes, as well as wet blues. In terms of value, the market is about 50:50 for each sector,” says Umar Riaz.

Novozymes’ distributor in Pakistan is a young company called Hostachem, which is owned and run by Khalid Khan. “Although Hostachem has only been in existence for four years, our relationship with Novozymes has helped us to double sales every year since 2002,” he says.

“We formulate Novozymes’ concentrates and also distribute new ready-to-use products such as NovoCor® AX and NovoLime™. Our mission is to become the leading specialty chemicals company in Pakistan, focusing mainly on environmentally friendly products such as Novozymes’ enzymes,” he says.

Complex processing
The process through which animal skins (goats, sheep) and hides (cattle) are turned into leather goods is highly complex and requires specialised skills that can take years to learn and master. The process is heavily dependent on the use of large quantities of toxic chemicals such as sulphides and chrome, and while this remains the case, new opportunities will continue to open up for the use of enzyme solutions.

A key step in the process is liming, in which hair, skin and other residual components are removed from hides and skins. Traditionally this has been done using sulphides, but the application of Novozymes’ NovoLime product at this stage of the process has greatly reduced the reliance on sulphides, with some exciting new benefits.

“NovoLime has been a revolutionary product in Pakistan. The results are excellent and the quality of the skin is improved dramatically. In addition, the use of less sulphide means less detrimental impact on the environment,” says Umar Riaz.

“This is becoming more important now with the involvement of the World Trade Organization in scrutinising exports and environmental damage.”

These sentiments were echoed by Khalid Khan. “NovoLime gives a far superior quality of leather that is also very soft. This helps our tanneries significantly because virtually one hundred per cent of production is for export and they are facing fierce competition from China and India. So any gains in quality are always welcomed by them!”

First post-tanning enzyme
Other Novozymes enzymes are finding a role further downstream in the process. In fact, NovoCor AX is the first enzyme that can be added after tanning. (Tanning is the process in which an agent displaces water from the skin or hide and cements the fibres together; the three most widely used
types of tanning agent are vegetable tannin, mineral salts such as chromium sulphate, and fish or animal oil.)

NovoCor AX allows hides to 'relax' even more than usual, giving them a bigger surface area that results in a higher-quality end-product as well as a better price (as leather is sold by area).

And even though this is a new technology, NovoCor AX is simple for the tanner to apply because existing equipment can be used. Furthermore, trials have shown that NovoCor AX gives softness without looseness and is especially suitable for soft leather types such as upholstery and clothing.

Barriers to expansion
But it's not all plain sailing for Novozymes and Hostachem in Pakistan, with a number of significant challenges and obstacles remaining. "One of the problems is that most tanneries regard enzymes as only appropriate for bating - the process in which skins and hides are treated with enzymes in order to produce a clean, relaxed and open structure ready for tanning. And some think they are dangerous. This may hamper our growth and we must convince them that the use of enzymes in other processes such as liming is sensible and cost-effective, and that it produces a high-quality product," says Khalid Khan.

Nevertheless, the relationship between Hostachem and Novozymes in Pakistan is providing tangible benefits for both partners and will allow many of these obstacles to be overcome. According to Khalid Khan, Novozymes' technical and commercial support has allowed Hostachem to penetrate the country's medium-sized and large tanneries, which would not have been possible without the high-end enzyme technology.

And from the other side, as well as providing Novozymes with a great distributor, Hostachem has its own tannery where Novozymes can carry out trials of its products in order to get the best results under local conditions and demonstrate the benefits of enzyme technology to customers. This represents a significant investment by Hostachem.

The future
Khalid Khan believes that, despite Hostachem's rapid rate of growth, even quicker growth rates are achievable through a combination of technological innovation and strategic vision. "We are the only distributor that is one hundred per cent focused on enzymes, which is the main edge we have over the competition. The strategy we have developed with Novozymes is to focus on new innovative enzyme products such as NovoCor AX and NovoLime to gain access to new customers. Once we have made an entry with these specialised products, we can go after the high-volume bating business as well," he concludes.
The year 2001 was a tough year for tanners. Mad cow disease (BSE) and the outbreak of foot and mouth disease in Europe disrupted supplies of hides and skins. Then came the events of September 11 that spurred an economic downturn in the US market. Prices for hides have fluctuated dramatically putting great strain on tanneries. During 2001, major tanners as well as many small operators were forced to close down.

In contrast, Shanghai Richina Leather (SRL), the second largest tannery in China, went on expanding and annual revenues increased by 42% between 2000 and 2001 to more than USD 80 million. SRL is a subsidiary of Richina Pacific. The company started in 1995 as a 55/45% joint venture between Richina Pacific, a New Zealand incorporated company, and Shanghai Leather, a state-owned enterprise. However, Richina Pacific now owns 95% of SRL, which is located on the outskirts of Shanghai and employed 1,500 people at the end of 2001, about double the workforce in 2000.

The tannery processes around 1 million hides per annum and 4 million pelts (lambkins). SRL is divided into three business units - shoe, upholstery and lambskin garment leather. Each unit has its own tannery of 8,000-10,000 m² and about half of the production is shoe leather supplied to high-profile companies such as Timberland, Rockport, Clarks and Wolverine.

3-4% yield increase
SRL started using Greasex 50 L for soaking in 2001 and now uses it for processing all the bovine raw hides and wetblues used to make shoe leather. Greasex is an alkaline lipase for the removal of grease and it is not widely used in the leather industry as yet. Dennis Thams, the CEO of SRL, has difficulties understanding why. “The area yield increase we obtain is 3-4% and we already had a good process where we controlled our yield very well, but we weren’t using enzymes for degreasing before.

“The average selling price of finished shoe leather is currently about USD 2.50 per square foot so if you multiply that by 3.5%, it adds up to a lot of money on one hide. We produce about 3 million square feet of shoe leather per month so a 3.5% increase in area yield is worth about USD 260,000 per month. We would be stupid not to use Greasex. It is just too good to miss,” he comments.

What about other tanners? Should they consider using Greasex? “That depends on how they apply products and whether Greasex is suited to their type of production, but in my opinion, Novozymes should be selling a lot of Greasex,” Dennis Thams replies.

Soaking without risk
SRL is using Greasex in the soaking stage whereas the normal approach is to add enzymes later on during the liming stage. Using Greasex during soaking raises certain worries about grain degradation for the tanner: will the enzyme attack the protein itself (the epidermis) rather than the material around it?

For tanners, it is reassuring to know that Greasex is a specific lipase preparation that only degrades grease and has no action on proteins. “Greasex has certainly worked well for us and better than anything we have used before,” comments Dennis Thams. “The results are a flatter and cleaner hide with better dyeing. The key factors are a combination of the area yield increase, the firmness and the flatness.”

NovoCor® AX for re-bating
The tannery in Shanghai also has high hopes for a new enzyme launched worldwide in 2002 by Novozymes. It is called NovoCor AX and is a new type of protease to be applied to wetblue for re-tanning and re-bating. It increases area yield and softness without the risk of looseness.

“Greasex® is too good to miss”
SRL was privileged to be one of the first tanneries in the world to test NovoCor AX. Preliminary small-scale trials with NovoCor AX gave a significant yield increase of 2-3% for shoe leather without any negative effect on quality.

“We applied it on wetblue. Traditionally, we could use an acid bate but that might lead to looseness and degradation. With NovoCor AX, the leather is maintained in its normal quality condition so it must act on the leather in a different way to the previous sorts of acid bates,” comments Dennis Thams.

Another unusual concept tried by SRL is to use NovoCor AX in the semi-acid part of the process - the neutralization process. With a pH optimum of 5.5 to 7, NovoCor AX is suited to being used at neutral pH. “Normally, a Tanner would not add enzymes at this stage,” comments Dennis Thams. “This is a completely novel application for Novozymes. It really is new technology.”

SRL is keen to try NovoCor AX in volume production and the first full-scale trials were made on upholstery leather in April 2002. NovoCor AX has also given good results in trials at SRL for opening up lambskins.

VIP treatment
Shanghai Richina Leather is one of a handful of tanneries around the world that work closely with Novozymes. These tanneries are known as the VIP Leather Club (Very Important Persons). Novozymes has a similar relationship with certain leather institutes for research projects.

The VIP tanneries give Novozymes a testing ground for new enzyme technology and a deeper insight into the leather industry. The tanneries benefit from being first to try new enzymes and from direct access to the expertise of Novozymes’ leather specialists. In the case of SRL, Lars Rasmussen, technical manager at Novozymes in Denmark, makes 3-4 visits to Shanghai a year.

“Shanghai Richina is one of the most innovative tanneries in the world. They know how to get the best results from enzymes by controlling their process,” says Lars Rasmussen, who is himself a tanner from Denmark. He has known Dennis Thams personally for many years.

“This agreement with Novozymes puts us at the leading edge when it comes to enzyme technology,” comments Dennis Thams, who is keen to build up SRL around a series of partners, both suppliers and customers.

“Novozymes is our declared enzyme supplier. We don’t buy enzymes from anyone else,” he adds.

China is incidentally the world’s largest leather producer. Wetblues and raw hides from around the world are shipped to China and other Asian countries for processing into finished leather.

A reality at last
Dennis Thams began his career as a leather technician in Australia. “I’m still heavily involved in the technical side here in Shanghai,” he says. “I’ve had 38 years’ experience in the leather business. Enzyme technology is something I’ve kept a watchful eye on for most of those years. Enzymes had a slow start in the early years but, these days, with the development and the specificity of the enzymes, they are starting to become a reality. I’m waiting for the next big development to be revealed by Novozymes!”
If all tanneries used NovoCor® AX, the total increase in revenues for leather would amount to about USD 5.5 billion. This estimate is based on a typical area yield increase of 3% but increases as high as 9% are possible in exceptional circumstances.

“The primary advantage of NovoCor AX is the higher area yield with no detriment to quality,” says Barry Wood, operations director of BLC (see box), which has developed the product jointly with Novozymes. Novozymes holds the patent rights for this new application.

**New for neutralization**

NovoCor AX was first launched in November 2001 and is the first ever commercial enzyme to be added after tannage. This new protease is added to the wet blue at the neutralization step. Previously, enzymes have only been used during soaking, liming and bating.

“Enzymes are generally used to remove the proteins you don’t want,” explains Barry Wood. “The protein is stabilized during tannage to strengthen and preserve the leather. Basically, the long chains of protein become cross-linked. It was thought that enzymes would have no effect after this stage because the protein structure was already ‘fixed’. However, at BLC, our researchers discovered that NovoCor AX does have an effect on the protein at this stage. It can make the hide ‘relax’ even more. The more you can relax the hide, the bigger the area. These gains go straight to the bottom line because leather is sold by area.”

**Easy to use**

Even though this is novel technology, NovoCor AX is simple for the tanner to apply. Existing equipment can be used and the enzymatic step fits in as part of the existing neutralization process. No extra time is usually needed and there is no risk of grain damage. Trials have shown that NovoCor AX gives softness without looseness.

NovoCor AX is only suitable for chrome-tanned leather because other forms of tannage interfere with the action of the enzyme. It is especially suitable for soft leather types such as upholstery, clothing and double-face leather.

Barry Wood is helping Novozymes to spread information about NovoCor AX and reports that there is a lot of interest around the world.●

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BLC (British Leather Confederation) started 80 years ago to support the British leather industry and is based in Northampton in the UK. Since 1990, BLC has become an international independent organization operating in 35 countries to provide a wide mix of services to tanneries. These include training, consulting, laboratory testing and research. The research is funded from a mix of public and private funds. The BLC has a strong track record of finding new technologies for the leather industry or improving existing practices.

Write to biotimes@novozymes.com for a NovoCor® AX product sheet.
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.

With over 700 products used in 130 countries, Novozymes’ bioinnovations improve industrial performance and safeguard the world’s resources by offering superior and sustainable solutions for tomorrow’s ever-changing marketplace.

Novozymes’ natural solutions enhance and promote everything from removing trans-fats in food, to advancing biofuels to power the world tomorrow. Our never-ending exploration of nature’s potential is evidenced by over 4,500 patents, showing what is possible when nature and technology join forces.

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