



Tannery of the Year: Zhejiang Dazhong Leather, Haining, Zhejiang province

Dazhong, located in China's Leather City, Haining, claims to have a longer history than any tannery operating in the country today; it will celebrate 90 years since its foundation during 2016. It produces leather for shoes, automotive and furniture upholstery as well as gloves. It is optimistic about the future of the leather industry in China.

Just as Paris is the City of Light and Los Angeles is the City of Angels, Haining, in the province of Zhejiang, is the City of Leather. It is fitting, then, that Dazhong Leather, now located on the outskirts of Haining, claims to be the oldest continuously running tannery in China. China's an ancient country and tanning is an ancient industry, but of all the 1,000 or so tanneries in production there today, none has been operating for as long as Dazhong's 89 (going on 90) years. "We're the only one that has survived from the old period," says company president Xu Jian Xin. "We've checked this all over China and the old tanneries have all disappeared now."

Production began at his company in 1926 on a site about three kilometres from where the tannery is today, closer to the city at a

location that has since been redeveloped into a park. There was a different name and a pause during World War II, but the operation that the founders set up in 1926 continued to run over the decades. Business soon picked up again after the war and the facility functioned as before until the 1950s when, as part of the new economic and social programmes of the time, the central government invited small tanneries to combine and form larger companies that now came into state ownership, a situation that endured until the end of the 1990s when, with the backing of investors from Europe, Mr Xu took up ownership. He and his family are now the sole owners. A few years later, in 2004 to be exact, he relocated the tannery to the current site, bringing with him a number of trees that grew up at the old site and have continued to



flourish in the grounds around the new Dazhong facility, offering a handsome symbol of continuity.

Raw material ups and downs

Dazhong processes between 1,800 and 2,000 raw bovine hides per day, in addition to a further 1,000 hides that it works with each day from wet blue or wet white to make automotive leather. It also processes around 6,000 sheep and goat skins per day. It brings in 95% of the cattle hides it uses at the moment from the US, with the other 5% coming from Australia and from European origins such as France, Spain and Ireland. The sheepskins the tannery processes come from the same European locations, plus the UK, plus some domestic suppliers. The goatskins Dazhong uses comes from Greece. Fluctuations in market prices for all these materials have little to do with the normal economic poles of supply and demand, in Xu Jian Xin's opinion. At the start of 2015, he says packers and traders were exerting an obvious control over market prices, deliberately pushing them higher and higher. "The decrease that has happened since then is a reflection of the fact that tanners voted with their feet," he comments. "Around 60% of all the raw hides in the US have been exported to China for some time but the volume coming to China fell by between 20% and 30% last year [2015] because of a downturn in demand here. This was inevitable because our leather footwear manufacturers have reduced their exports by 20%." He anticipates that prices will be stable in 2016, which he welcomes. "Stability is good," he says.

For Mr Xu, the innovation that suppliers of machinery and leather chemicals promise is attractive in theory, although he also places great importance on reliability, good service and good availability of consumables where machinery providers are concerned, and on research into new ideas from chemical manufacturers. "It's good when we can work together with suppliers to come up with products that solve the challenges we face, such as energy saving and making production more environmentally friendly," he says. Specific areas of interest include innovative chemical solutions for retanning and finishing and machinery for upgrading the quality of finished leather by covering defects in lower grade hides to increase cutting yield, but using light finish only. "Domestic-focused producers of shoes want



Solar panels cover around 50,000 square-metres of roof space at Dazhong Leather generating approximately 5 GWh of electrical power per annum. This makes an important contribution to the company's policy of saving money on energy while also contributing to cleaner air for the city of Haining.

the leather to look like it has no damage, whereas those focused on exports prefer the leather to look more natural, so there's a delicate balance to strike," he continues. "It's hard for us to change the minds of the shoemakers. How consumers in China think about leather needs to change. They want no scratches, no defects."

The footwear market in China

China's footwear exports certainly suffered a bit of a dip in 2015, but shoe upper is still the core business of Dazhong Leather, accounting for 50% of output (automotive takes 35%, gloving leather 10% and furniture upholstery the remaining 5%), and there is more to life for footwear producers than export markets. Mr Xu explains that there are still four main production regions for leather footwear in the country: the clusters in the provinces of Guangdong and Fujian, and those around the cities of Chengdu and Wenzhou. Chengdu manufacturers in particular have experienced a downturn of more than 40% in their output of finished shoes this year because a lack of demand from their customers, traditionally in Russia and other parts of eastern Europe. To compensate, though, consumption rates in the vast domestic market are going up.

"Across China, women are now consuming between four and six pairs of shoes and boots each per year," Mr Xu says. "For men it's two pairs. These are national

averages, not just for the urban population." The CIA World Factbook's figure for the population of China in July 2015 was 1.367 billion, with slightly more men than women (a ratio of 1.06:1). Mr Xu's figures, therefore, suggest there are roughly 705 million Chinese citizens each buying two pairs of shoes a year and 660 million buying five pairs. This puts domestic shoe consumption in China at the astonishing figure of over 4.7 billion pairs. The last time a tanner in China shared information on this subject with *World Leather* was in April 2011 and the figure for overall footwear consumption in the domestic market then was 3.1 billion pairs, which was a much higher figure than influential industry reports were offering at the time. In less than five years, it appears that the total for annual consumption in China has gone up by more than 1.6 billion pairs.

Fewer tanneries

During that time, the number of tanneries operating in China has declined, suggesting on the face of it that there are even stronger grounds for optimism around shoe upper leather demand for those that remain (it's a growing market with fewer companies seeking to supply it). Mr Xu is wary of making a direct comparison between the number of tanneries functioning in 2011 compared to those in the industry in China today. The China Leather Industry Association, of which the Dazhong Leather



From a technical point of view

(1) Overview of operations

Zhejiang Dazhong Leather is situated within an economic development zone in Haining, Zhejiang province. The tannery has operated on this site since 2004 and now has a total building area of 100,000m², and employs 490 people.

The tannery consumes between 1,800 and 2,000 wet salted hides per day, mainly purchased from the US, the majority being processed as chrome-tanned leather, but with a small volume being chrome-free. This is supported by approximately 1,000 hides per day purchased in the wet blue and as chrome-free, mainly for automotive manufacture. Also, 6,000 wet salted sheepskins per day, mainly of Spanish origin, and some goatskins are processed as chrome-tanned leathers.

Approximately 1,000 hides per day are processed for finished shoe upper leathers, at 1.3mm for lightly finished full grain nappa, floater, nubuck and white sports leathers, 100 hides per day as lightly finished and waxed furniture leathers, the balance being automotive leathers which are processed to the (crust) pre-finished state.

The sheepskins are mainly used for fashion and golf-glove purposes, but also as conductive gloving leathers for use with touch-sensitive display screens. A small proportion is used for clothing leathers.

(2) Manufacture and processing

All of the bovine hides are processed from the salted state as input loads of six tonnes each in conventional drums of diameter 3.0m x 3.5m width. Seven drums are available for a dirt soak of 12 hours, being followed by fleshing using two elevated fleshing machines operating in tandem. In this operation the first machine fleshes the butt part, followed by chute delivery to the lower machine for fleshing the neck area, then trimming. The hides are then soaked for 18 hours using a double set of seven drums served by a central mezzanine, followed by a 20-hour liming, all served by a comprehensive



All of the hides are fleshed after soaking, and then split after a hair-burn liming.



Within the dyeing department there are two new tri-section wooden drums, fitted with stainless steel Y-section interior divisions. Each vessel has a capacity of 200 hides per load.



Shows part of the pilot plant for small-scale development work comprising seven stainless steel drums of various sizes. Physical and chemical testing laboratories are located nearby.



All of the automotive hides are toggle dried, and sold in the pre-finished state.



water-metering system. A hair-burn system is being operated at the moment, although hair-saving techniques and recycling of used lime liquors is being investigated. This is followed by lime-splitting as full hides.

Tannage takes place in an adjoining department comprising a double bank of 16 elevated drums, then samming, grading and shaving to substance as whole hides for automotive and furniture use, or sided for upper leathers. The dyeing department comprises 14 conventional wooden drums, and two wooden drums with perforated stainless steel interior fittings as tri-sectional vessels, each with a capacity of 200 hides.

The production is then samm/set, with the shoe upper leathers together with the furniture leathers being vacuum-dried. Drying is completed either by drying in a bank of toggle drying frames, or tension-free using a line-track conveyor system. This is mounted in the roof area, and is supported by drying cabinets if required.

All of the automotive leathers are separated after samm/setting, and are toggle dried by throughfeed whole hide toggling. The softening of these leathers is provided by conventional throughfeed staking machines, and a batch of 17 milling drums as appropriate.

Both the shoe upper and the furniture leathers are finished in the same department. The upper leathers are lightly hand padded, then spray finished using four spraying units. These leathers are ironed after first and final coat applications using four Rota presses fitted with smooth or engraved cylinders, with heavy embossing provided by five embossing machines. All of the furniture leathers are full grain and lightly finished in a separate section of the department, and normally receive a light wax coat via a Gemata roller-coating machine before light rolling.

The sheepskin production is processed in a separate wet end and finishing department. On receipt, the skins are trimmed and sorted into four grades for area, and the wool loosened by a sulfide paint application. After de-wooling by hand and then liming, the skins are lime split, tanned then graded for quality.

After dyeing, retanning, fatliquoring and setting, the skins



A combination of vacuum drying and airing off is used for drying footwear leathers.



There are 17 milling drums in total, set in two banks.



All leathers are lightly finished. This mainly comprises a light first pad coat, with the finish built up by spray applications.



In addition to four roller presses, five embossing machines are used within the upper leather finishing plant.



are dried using three horizontal throughfeed toggling units fitted with expanding frames. Finishing is based on spray-finishing of both lightly pigmented finish but also wax coatings followed by burnishing.

The tannery also has a pilot plant for development work fitted with seven stainless steel drums. There is a physical testing laboratory which is mainly used for measuring tensile strength and lastometer values. The chemical control laboratory is used to provide ongoing effluent analysis, basic leather analysis, but also for checking dyes, retanning materials and fatliquors for consistency against standards. The tannery has received ISO 9001: 2000 accreditation and ISO 14001 in 2012.

(3) Solids management

- Green fleshings and limed trimmings are processed for animal feed.
- Limed splits are sold.
- Recovered wool from de-wooling sheepskin is sold for fertiliser.
- Wet blue splits from wet blue purchases are processed in-house for final leathers.
- Chrome shavings are sold for leather fibre-board manufacture.
- Pallets are used for stacking leathers, and the excess sold.
- All finished trimmings are sold.
- All barrels and used containers are sold to a licensed company for cleaning and reuse.
- All sludge from the effluent treatment plant is free of chrome. This is dewatered by filter press to produce 8–10 tons of cake each day, then sold for use as fuel on an industrial scale.

(4) Water and environmental management

[a] WATER

All water used within manufacture is abstracted from a small river that runs adjacent to the tannery. After full effluent processing the treated wastewater is discharged into the main drainage system where it is mixed with other effluents, then subjected to municipal effluent treatment.

[b] EFFLUENT TREATMENT

Approximately 4,500m³ of wastewaters are treated each day within the tannery effluent treatment plant. From processing, the effluent is segregated at source into three streams:

- Sulfide-containing wastewaters and washings
- Chrome-containing used floats, washings and drainings
- The remaining wastewaters

All of the sulfide-containing discharges are screened, then collected and mixed in a single collection sump located within



All of the chrome wastewaters are segregated. After precipitation, the chromium hydroxide is dried by filter press, and the cake dissolved in sulfuric acid as shown before pH adjustment.



Sulfide containing wastewaters are acidified in the two sealed tanks to the left, and the evolved gas dissolved within the two columns to the right to regenerate sodium sulfide for use in liming/unhairing

the main effluent treatment plant. This solution is pumped from the holding sump into a pair of sealed, vertically mounted tanks where the pH is adjusted to 6.0 to liberate hydrogen sulfide. This is flushed from solution using compressed air, then removed from the gaseous emissions by dissolving in sodium hydroxide solution. This is performed in two scrubbing tower units set in series. All of the hydrogen sulfide is recovered as a solution of sodium sulfide, and the scrubbed air, being odour-free, is discharged into the atmosphere. The regenerated sodium sulfide solution is reused in the subsequent unhairing and liming processes. The acidification operates as a batch system, each cycle being approximately 30 minutes. The protein precipitates from acidification are mixed with the other solids from effluent treatment.

All of the chrome-containing wastewaters are screened then collected in a single sump for homogenisation, settling and separation of floating solids. The settled effluent is then pumped into a second tank for alkali precipitation, with the



The Pasveer ditch has sufficient capacity to retain the effluent for one day for biological treatment. The image shows the wire brushes used for circulation of the effluent and the introduction of air into the system.

sludge being dewatered using a conventional filter press. This press is elevated so that when it is opened the dewatered chromium hydroxide cake can readily drop to the floor. Here, it is broken into small pieces and delivered using a belt conveyor into a reaction vessel where it is dissolved in sulfuric acid to form chromium sulfate. Finally, the solution is pumped to a sealed reaction vessel where it is adjusted to pH 2.6 using sodium hydroxide solution. The chromium tanning solution formed is used in subsequent tanning loads.

The remaining wastewaters are screened and, after the treated wastewaters from sulfide and chrome recovery are mixed, are chemically dosed with ferrous sulfate solution to remove soluble components to lower the COD, BOD and solids.

This process is followed by primary clarification, with the supernatant delivered to a Pasveer ditch arrangement for biological treatment. Here, the effluent is circulated in a raceway where alternating aerobic and anaerobic cycles are created to lower the BOD and COD, but also to lower the nitrogen component. This is followed by an extended anaerobic treatment to ensure final removal of nitrogen, then secondary settling and discharge from site. All of the sludges from the different stages are mixed to thicken, then dewatered using conventional filter presses.

The sump used for holding the sulfide-containing discharges, and the sludge-containing tanks have all been tightly capped using heavy duty polythene covers. Air is continuously drawn from the sealed volume between the



All parts of the effluent treatment plant where airborne odour can occur are covered with heavy-duty plastic covers. Air is continuously extracted and washed to remove these components using two scrubbing units before discharge to atmosphere.

cover and the liquid surface to prevent wind-borne spread of odour. The extracted air is then scrubbed using two wet scouring towers to remove any odour, before finally venting to the atmosphere. The scrubbing solutions are ultimately treated by discharge into the main effluent treatment plant.

The site operates to stringent discharge limits set by the municipal authority. Control includes continuous sampling and automatic analysis by the authority, with the results recorded by internet. This equipment is sealed, and surveillance cameras are used to continuously monitor both this area and the point of discharge from site. The site is open to inspection at any time, and this usually takes place once per week. All of the municipality's analysis is made available via the internet to anybody who wishes to monitor performance.

[c] ENERGY

The steam required by manufacture is purchased from a steam generating plant that provides energy to a cluster of industrial sites.

Around 50,000m² of the roof area is covered with photo-electric panels for the generation of electricity. This is the result of a joint project in 2015 between the company and an external partner. The power generated is approximately five GWh per annum which feeds directly into the national grid, whereas the power use of Dazhong Leather is approximately 80% of this level. As part of the agreement, this power is purchased back from the national grid, but at a reduced cost per unit of electricity. ☺

owner is currently a vice-president, has said a figure of 1,800 operating tanneries in 2011 had reduced to 1,000 by the autumn of 2015. "The way of calculating who makes it onto the list and who does not has changed," he explains. "Five years ago, all companies with sales of about \$750,000 per year were counted. Now the cut-off for being counted is an annual sales figure of

\$3 million and companies that are smaller than that are being closed down or have already disappeared." He says he does not know why some companies have survived and stuck with leather while others have ceased production and insists he cannot speak for the industry as a whole. But as far as he is concerned, he says he is still involved because leather is his passion. He

has other business interests, as an investor, but it's leather he knows and leather he loves. In fact, he says his whole family loves leather. His wife, Liu Yu Qing, is general manager of Dazhong Leather and their daughter, Xu Yang Yang, has spent time in Europe in recent years studying leather technology and perfecting her English in preparation for a time, her parents hope,



Basketball is always popular among Chinese tannery workers. Teams from the nine tanneries in Haining compete in a Leather City championship.



Dazhong Leather claims to be the oldest tannery still in operation in China. Trees from the company's original site were replanted when it relocated in 2004 and offer a symbol of continuity.

when she too will take a frontline role in running the tannery. Liu Yu Qing's nephew and her nephew's wife also fulfil senior roles in the business; it's a family affair. "I've been in the industry 30 years," the company president says, "and in that time, lots of new industries have come along. Well, I think leather is more sustainable than many of the new industries and will outlast lots of them."

"Cautiously optimistic" future

He describes himself as "cautiously optimistic" about the future of the leather industry in China. It's true that there is great speculation about the increase in trade between member countries of the Trans-Pacific Partnership (TPP) and the lucrative consumer markets of North America and that China has missed out on that particular

party, but Mr Xu says this causes him little worry. He says: "TPP won't have a big effect on this tannery. We are not dependent on exports. The consumption of most of our leather is domestic and consumer spending is still increasing here in China, perhaps not at the same rates as we saw a few years ago, but the main point is that people are spending. And while we have become better at controlling costs and keeping quality high, our TPP competitors will see their costs increase when free trade under the agreement starts [12 countries reached agreement on TPP in October 2015 and expect ratification in the course of 2016 and 2017]."

Costs for tanners in TPP countries such as Vietnam will increase, the Dazhong president insists. He says tanners he knows

who have already moved production to Vietnam ahead of TPP, and to other countries in the region such as Cambodia, have found their costs doubling year on year. "Their costs will continue to go up enormously," he says. "That's what happened in China, whereas our costs are stabilising now. Those countries have lower labour costs for now, but their people will demand more and more, and costs for environmental management will go up there, too, so it will not be easy or cheap for big operators to set up there. And here in China, our economy will recover and go up slowly for the next few years and then stay stable."

Leather City

Haining now has nine tanneries, making the industry still influential there, although these days the 'Leather City' tag probably owes more to the colossal complex of shopping malls in the middle of town, dedicated variously to apparel, bags, shoes and gloves, with brand after brand, shop after shop in modern, well laid out centres. People come from all over China by car and by bus to buy and the complex also hosts a design centre and a museum. Haining clearly owes much to its leather traditions for its ability to attract these shopping tourists, but it offers no concessions in terms of regulation to its remaining tanneries. The authorities are proud of their leather heritage but they are strict when it comes to environmental management. There is an understanding among industry figures that the city authorities, who are able to keep employment and prosperity levels healthy, would simply close down any manufacturing company that failed to respect environmental regulations or workers' rights.

Among the steps Dazhong has taken in response is a sophisticated odour management system (see the technical section of this report for details). A new-build campus run by Zhejiang University is only a few kilometres from the tannery and the leather producer knows complaints would come thick and fast from its neighbour if its precautionary measures failed and odour became a problem. In a similar way, devoting 50,000 square-metres of the roof surface on its buildings to solar panels (see technical section) means the tannery is making a significant contribution to cleaner air, a hot topic in many Chinese cities and something that affects the quality of citizens'



lives directly. The expanse of solar panels is quite a sight; it's a remarkable advancement on the times when, at the very most, a company's roof might earn it a small amount of money by hosting an advertising banner or a mobile phone mast. "One day, this [the solar panels] will be normal," Xu Jian Xin says. A small river, the Lujiabang, flows just 20 metres away from Dazhong's extensive wastewater treatment plant. Fish and flowers are easy to spot in and along the river. The authorities in Haining have given manufacturing companies responsibility for looking after stretches of the river, of around 2.5 kilometres each. They asked each company to nominate a champion for this environmental project; Mr Xu, who is active in local government and serves on the city's senate, nominated himself, showing that responsibility for the environment goes to the top of his organisation.

With a new national government in place in Beijing since 2013, manufacturing company owners know that they must take their responsibilities seriously because, under the new regime, breaches such as allowing untreated effluent to flow into rivers can bring jail sentences. The days of being able to pay a fine to avoid jail have gone. Talk abounds in the Chinese leather industry of officials in some provinces using drones equipped with cameras to fly over tanneries to make sure that effluent treatment plants are operating. They give no warning and they will accept no excuses; they are now able to have remote-controlled monitoring of industrial sites for an investment of around \$1,000.

Work-life balance

Workers at the tannery take part in a range of sports activities, with basketball and ping-pong the most popular. Dazhong Leather has also taken steps to promote the company and the whole Leather City concept by becoming a major sponsor of an important snooker event that Haining has hosted since 2014. It's called the Haining China Leather City Open and has had Mr Xu presiding over the awards ceremony at the end of the two years it has run so far (the tournament was won in 2014/2015 by the current world snooker champion Stuart Bingham). He says he wants the public to see the leather industry in a positive light. "If the public only ever sees negative stories about leather it will inevitably form a negative impression of



Diverse portfolio. Dazhong produces leathers for gloving as well as shoe upper, automotive and furniture upholstery.

our industry," he says. "It's very important to show positive stories. Maybe it will bring us little immediate benefit, but the benefits will come in the future and we can look forward to that time."

In all, 490 people work at the tannery. Some live in an onsite dormitory, in some instances, thanks to air conditioning and private bathrooms, with their families, and others in Haining. There's a labour union and if any member of staff has a family problem, the union provides support, but it's Dazhong Leather that supports the union. Union contributions equate to 4% of each worker's salary, but the company makes that contribution each month on its employees' behalf. The company also steps in to help with special cash payments in instances of particular emergency or sudden hardship. There is a loyalty payment scheme in place, too, with workers earning a monthly loyalty bonus dependent on their years of service; this reaches about \$30 per month extra after seven years with the company. It also offers workers from other provinces travel expenses for one return journey home each year and has a home-loan programme in place for people in middle-management positions.

Asked if life is improving for workers in China, Mr Xu laughs and says he thinks, if anything, there is sometimes excessive consumption, with credit card debt on the increase. There is a parking area outside the tannery which five years ago, might have had two cars in it on a normal working day.

Now there are more than 60 cars parked every day and it's no longer big enough.

Haining is expensive, being two hours from Shanghai and prosperous in its own right. For this reason, the company has decided that it must focus on high-quality, high-value leather, rather than on high-volume, low-margin production. A change began in most of China's major tanneries about five years ago, Xu Jian Xin says. As a result, he contends that China is no longer a low-cost country and no longer seeks to compete on price, but on quality and efficiency.

His view is that Dazhong Leather is a good example of this, presenting the tannery as an organisation that cares more than most about energy saving and being environmentally friendly. "We are genuinely sustainable," the company president says, "and this is the result of continuous growth. We are not the biggest, but we started in 1926 and are the ones with the longest history." Those close to him believe that another benefit Mr Xu brings to Dazhong Leather is that, of all the industry leaders in China today, he is the one with the most experience and hands-on knowledge of making leather. He started in the industry in 1982 and worked his way up, taking time out at the end of the 1980s to complete a university course in leather science before returning to his place of work to take up management roles. "Leather made me a leader," he says now. 🌐