



The tannery runs separate lines for vegetable, chrome - tanned and sole leather.

Tannery of the Year: Sepici Grubu, Torbali-Izmir, Turkey

A family-run tannery near Izmir in Turkey, Sepiciler runs separate production lines for vegetable- and chrome-tanned leather, as well as for sole leather. It has clients in high-end markets across Europe, Asia and North America.

The tannery has close links to one of the universities in Izmir, with members of the Sepici family taking up lecturing roles there and a number of members of the academic staff reciprocating by spending part of their time at the tannery. One well known figure, Dr Yalçın Dikmelik, has been involved since the 1980s and still serves on the board. Current company chairman, Mehmet Sepici (a representative of the third generation of this family company), laments that, although 30 or 40 graduates come out of the leather course successfully each year, only 10 of them will stay in the industry.

The name Sepici means 'tanner'; in 1934, the founder of the

Turkish Republic, Mustafa Kemal Atatürk, decided that a tradition in which most Turkish people had no surname must end and that those without a last name must choose one. The founder of Sepiciler, the original Mehmet Sepici, worked first for a tanner in Izmir before setting up his own business in 1930, specialising in sheepskin for shoe uppers and for hats. The first independent Sepici tannery was in the Basmane district near the main railway station, but in 1955 the founder chose to move further away because of lack of opportunity to grow the business up. The Sepici Tannery formed in the new site in an outlying suburb called Yesildere shared a similar fate because they still wanted to get their business to a higher level. For Sepiciler,



Sepiciler has a very significant historical collection of leather articles – bags, shoes, saddles, mouldings, garments and hand tools used in leather manufacture which have been collected over many years. The example shows one of the best pieces in their collection; a set of Turkish horse blinkers.

the definitive move to the current site took place in 1974. It's an area covering 300,000 square-metres, 45,000 of them occupied by the various tannery buildings, but surrounded by fields and trees on three sides and a busy road on the fourth. The family chose to set the factory in Torbali area because of the water sources.

One of the founder's sons, Talip Sepici, says he is now retired but still goes to the tannery, still wears overalls and seems to be involved in much of what happens there and in the wider industry; he taps away at an iPad much of the time. "I always wanted to be a doctor, really," the company's most senior representative today says with a laugh, "but of course I worked in the tannery to help my family. Then, before I knew it, I was in Reutlingen, in Germany, in the exceptionally cold winter of 1962 to learn about leather instead, and as you can see I am still in the business. Much has changed over this time. In the early days Turkey was a closed economy and it was hard for us to import the chemicals we needed. Now, everything is easy to buy and to produce, but less easy to sell. Now marketing is the key."

Production-line diversity

Four production lines occupy most of the space inside the tannery buildings. The first of these is for vegetable-tanned leather that is in high demand among big-name luxury brands for handbags and other accessories. This part of the Sepiciler set-up, consumes

high – quality European hides to give the best vegetable products.

Sole leather is the focus of another of the production lines. This was one of the original activities that the company's founder, Mehmet Sepici, engaged in. However, because of the difficulty in importing essential raw materials, he stopped and devoted himself to producing glazed kid leather instead. In 1989, his successors took the decision to go back to sole leather, targeting clients in the women's and men's footwear industries. The sole leather line produces up to 75 tonnes of crust.

Sepiciler also has a chrome-tanned leather production line, although the company is working hard to reduce the quantity of chrome and other heavy metals it uses and between 2005 and 2012 succeeded in bringing down the amount of its wastewater that contained chromium sulfate from 8% to 5.5%. In parallel, it's working with a Turkish chemicals supplier to develop a tanning solution it calls Ecoltan to decrease further the chromium content in the discharge solution and, at the same time, the quantity of salt. The company aims to complete a pilot project by September 2012 and has even looked ahead to the potential production of an important spin-off, converting sludge from the tannery into organic fertiliser. "Sludge is our biggest waste product," says Yigit Kaman, a young environmental engineer who has been working at the tannery for two-and-a-half years, "and including

transport, it can cost us up to €20 per tonne to dispose of it. This is a better idea. Sepiciler has always been a pioneer in environmental management, setting up the first effluent treatment plant in the Turkish leather industry in 1989. We have to keep innovating because the regulations are becoming stricter all the time. In ten years time, for example, no tannery will be able to put fleshings into landfill."

He argues that every action to make the tannery's operation more sustainable, from building the effluent treatment plant to recycling paper, is action the company takes because it is the right thing to do. Earning recognition, and even money (€5 for every 100 kilos of recycled paper is the going rate) are not the motivation. "It's not about the €5," he repeats. "You do it because, if you can keep it up for a year, you save five trees."

Although it's not processing small skins at the moment, it's working in full capacity to support bovine production.

Across all working production lines, monthly input capacity is 600 hides for chrome tannery, 350 for vegetable tannery and 400 for sole leather tannery. There is a total output capacity for chrome and vegetable around 70,000 square meters and 70 tonnes of sole leather as sole, cut sole and ready sole.

Europe used to be the prime market for most of this material; it still accounts for around 50% of the finished leather Sepiciler produces, with 30% going to Asia and 20% to the US.

Machine-minded

In addition to its investment in equipment, such as a brand new vacuum dryer from Cartigliano (it arrived the same day as the Tannery of the Year team), Sepiciler has its own talented maintenance squad, whose recent successes include taking a 25-year-old automated roller press from the sole leather production line and making it "as good as new". One of the advantages of state-of-the-art technology such as the Cartigliano dryer, of course, is increased energy efficiency; in this case, the promise of a reduction of 75% in the amount of energy the drying operation consumes was enough to convince Sepiciler to invest.

Its willingness to invest and embrace the best technology it could goes back a long way. Dr Dikmelik recalls that in the mid-1980s, Sepiciler told him it wanted to set up a laboratory and asked him how the company should go about it. He said that the fundamental thing was to buy the best possible scales to be able to weigh materials



From a technical point of view

(1) Overview of operations

The Sepiciler tanneries are located on a three hectare site at Torbali, about 40 km from Izmir. The tannery buildings occupy 45,000 m² area, the balance being used by the company for farming purposes.

There are four self-contained tanneries producing vegetable and chrome tanned side leathers, vegetable tanned croupions for sole leathers, and goat skins. All are equipped to operate from raw hides or skins to the finished state. There is a single laboratory for physical and chemical testing serving the tanneries, a single purchasing department, and two materials storage facilities, a single wastewater treatment plant, and a composting facility. The combined tanneries employ approximately 200 people.

(2) Manufacture and processing

All of the raw hides and skins are inspected and trimmed on receipt, and if not for immediate input stored in a specially constructed refrigerated facility.

THE CHROME TANNERY

The input capacity of this unit is 480 ton hides / month, producing a substantial quantity of crust and finished leather. The target market is mainly shoes and sandals, handbags, upholstery, technical leathers (military footwear and waterproof), garments, binding's belts and hats. The products are finished as aniline, nubuck, suede, oil/waxy textures or as required.

The major equipment comprises three soaking/liming drums, three tanning drums and seven vessels used for retanning. Drying is by vacuum drying followed by air drying on an overhead conveyor. All of the water used within process and chemicals in solution are added under computer control, and where hand additions are required, if the times are not met, then alarms are activated.

Process efficiency and the reduction in chemical waste is being managed in several ways. Nitrogen containing chemicals used for deliming have been replaced or decreased to lower the nitrogen in wastewaters, and the float levels in pickling and tanning have been reduced saving 60% water, thus reducing the quantities of salt and acid required in process. In addition, manufacture was changed from blue to lime splitting two years ago, and this resulted in a reduction of chrome offered to tanning to 66% of previous offer for the same input.

More recent development using a chrome containing auxiliary is producing leathers with the same chromium content as the tannery standard wet blue, but with improved chrome exhaustion, hence less wastage. This product also enables a decrease in both salt and acid requirements. Further development with a chemical provider of new wet-white tanning agents is also taking place with the objective of chrome-free leathers with use of the exhausted tanning bath and washings in the liming process, and with combination systems. The objective of these two developments is to minimise chrome usage, to eliminate the need for salt in pickle, and minimise acid additions.



On receipt, raw hides and skins are inspected and trimmed. If they do not go directly into production they are held in store under cold controlled conditions.



In the beam house and tanning departments there are 6 Vallero wooden drums which operate with a raw input weight of 6 tonnes per load. The tanning drums are fitted with heating systems which are used to improve the uptake of chrome in the tanning process.



The splitting machine employs an elevated table for optimum feed to the splitting machine. The machine is fitted with a dust extraction unit to collect and scrub the dust generated at knife point by the operation.



THE GOAT SKIN TANNERY

In past years this tannery was operated for glazed kid production but it is working in its full capacity to support the bovine production.

THE VEGETABLE TANNERY

The input capacity of this unit is 240 ton hides / month, producing high quality vegetable leather mainly for export. The main end use is for upholstery and leather goods, shoe uppers and sandals, decorative at a range of 1.0 – 3.0 mm, and saddlery leathers at 4.0-6.0 mm. These leathers are completely natural, aniline and semi-aniline, oiled waxed and nubuck.

In this tannery the major equipment comprises two soaking and liming/unhairing drums, two drums for deliming, two tanning drums made out of wood, and two from polypropylene. The tannage takes four days, and is based on blends of mimosa, quebracho and chestnut. After tanning the sides are sammed – with careful attention to avoid staining, to apply level pressure and provide uniform dewatering. After shaving, the leathers are retanned and fatliquored in five retanning drums, then samm set and air dried in drying cabinets in a carefully controlled environment to avoid staining and takes up to three days.

Corrected grain leathers are buffed, impregnated and re-buffed, and aniline leathers lightly finished using roller coaters and two double headed spraying machines.

THE SOLE LEATHER TANNERY

Sole leather manufacture started in the 1930s, and was completely refurbished in 1989. The tannery is now producing 75 tons crust / month of leather for soles, insoles, floor tiling and decoration, welting, heel covers and nubuck.

The processing starts using three drums for soaking, liming and deliming, with lime fleshing using an elevated fleshing machine. A series of 16 pits and three drums are managed for tanning in the following way:

The delimed pieces are suspended from frames, and then immersed in the first pits containing residual tannins for



Pieces undergoing pit tanning as the first stage of sole leather tanning. The pieces are regularly raised on the frames to avoid prolonged contact between pieces, thus avoiding colour variation and ensuring uniform penetration of tannins.



Billeri drums are used after 14 days in the pit system for the final tanning stage. This stage takes three days, and mimosa, quebracho and chestnut extracts are added to this bath to maintain the tannin concentration of the float.



In the final stages of manufacture, the croupones are measured for substance, then rolled to compact the fibre structure. This machine is fully guarded, and will only operate with the operative standing on a pressure sensitive plate.



The sole leather and vegetable tanning tanneries are managed independently to avoid any contamination and avoid staining. A slow and controlled drying over a period of three days is needed for drying these vegetable tanned sides.



Both the chrome and the vegetable tanneries have their own finishing departments. Both are fully equipped with roller coating machines, spraying machines and roller presses and embossing machines. These are not linked together as there is a wide variety of leathers being manufactured at any one time.



Particular attention is given to the break characteristic, especially with vegetable tanned leathers during final selection and grading.

one day for colouring. The hides are then transferred into the second set of pits containing higher strength vegetable tanning extracts in solution, and retained for two days. The third set of pits contains stronger tannin solution, and the hides are immersed in these solutions for eight to 11 days according to the type of leather being made. During this time the hides are raised on the frames to avoid kiss marks and to encourage good mixing and distribution of tannin solutions between the hides. The hides are finally removed from the pit system to the tanning drums to complete the tannage using concentrated solutions. This normally takes three days.

The used tan liquors from the drums are high in tannins, and are discharged into collection sumps. Part of this liquid is returned to the tanning drums, and made up to strength with fresh extract. The remaining liquor is pumped to the third set of tanning pits, where it is gradually depleted in tannin strength over the eight to 11 day period. Once the tannin concentration has been reduced, these liquors are discharged to the second set of pits as a weak tanning solution, then finally used as a weak depleted solution of tannins in the first colouring process.

After samming to remove water and residual tannins, the croupions are levelled by shaving to remove loose fibres, then retanned and oiled in five retanning drums. After piling, each piece is hand washed on the grain, then set and roll-pressed to compress the fibres. The pieces are then suspended to dry in carefully constructed drying rooms over a period of three days.

Finally, the leathers graded into five categories for thickness, then rolled with the pressure appropriate for that thickness, before measuring and grading.

Part of the production is sold as finished leather, but there is also an adjacent department where components are cut from the croupions. These components are mainly for soles, insoles and linings.

accurately. A scale made by Mettler of Germany, accurate to four decimal places, was available in Izmir and the tannery bought it; it still works.

Raw materials

Between 25% and 30% of the bovine hides Sepiciler works with come from Turkey. France, Germany, Ireland and the UK are also popular sources, with some wet blue coming in from Italy too. It works directly with some abattoirs as well as through traders. "The domestic breed in Turkey is usually Holstein and the hides have a really nice grain," says current chairman, Mehmet Sepici, "but the main problem is that they often reach us untrimmed. Another thing we would prefer not to have is a mix of bulls and cows all in

together." Abattoirs across the country are advanced enough, he continues, but there are often some signs of inexpert work in the slaughterhouse, such as hand-flaying; workers are trained to care about the meat, not the hide. This is improving slowly, the Sepiciler chairman says, but there is still a long way to go. It's not so easy to make abattoir workers understand the value of the hide and the damage they can do to it through a lack of care and attention.

Changes in Turkey

The proportion of raw material the tannery sources from its domestic market used to be much higher, up to 60%, but a recent change in the way the Turkish meat supply chain works has led to the stark reduction. Live animal imports are on the

increase and Sepiciler simply says it is unhappy with the grain quality of the hides of the cattle that are coming in. Argentina and Uruguay are popular origins, with Angus cattle from those countries a frequent choice. Animal feed has become very expensive for Turkish livestock farmers and the price of meat has failed to keep pace, making increases in the imports of live cattle unsurprising. "But the dealers don't wash the hides well," Mehmet Sepici says, "and with all that hair on the Angus, it's not unusual for us to find as much as five kilos of dung on a hide. It's not for us. We have to understand our raw material and feel it to be able to add value to it."

He explains that when the company started its vegetable-tanned production, it initially ran at less than full capacity. But



orders increased and it invested in more machinery and bought hides from all possible sources. "And we were selling," Mr Sepici says. "Then we understood that a focus on quantity is not the same as a focus on quality and, for the last ten years, our focus has been on quality instead. It's not about trying to tan more and more hides but about tanning fewer higher quality hides and selling them for a fair price."

The lack of sheep and goat skins moving through the tannery at the moment is interesting given Turkey's traditions in tanning small skins. Mehmet Sepici explains: "As a business we decided to move away from that. We feel the quality of goatskins has been going down for the last 25 years. Plus, the herd size has gone down. Farmers frequently took goats to the forest and the animals caused substantial damage by eating the new leaves." When the authorities realised the extent of the damage goats were causing, slaughter of the animals went up sharply and the size of the national herd dipped, to 7.2 million head in 2011 from more than 24 million 50 years ago. Some signs of recovery are on the horizon. Goat's milk and cheese are becoming more popular and consumer product brands are making inroads into the ice-cream market with a range made from goat's milk. The size of the national sheep herd in 2011 was 23.9 million. Sepiciler's figures suggest that across all animal types around 17% of livestock herds in Turkey will go to slaughter in an average year.

Mr Sepici explains that his company follows the price of raw materials every day and has reached the conclusion that, if raw materials suppliers can test the market around the world with a good price (for the suppliers) for good quality hides and a lower price for lower quality, it's not the same for tanners, because tanners are not all in the same situation, he says. "Some governments help their tanners," he suggests, "for example with bank credits, which allows the tanners to secure the best quality raw material. US hides, for instance, seem to us to be very expensive. The US has to sell because it produces a lot of hides, but we make our calculations and it's clear that it's hard for us to be able to afford them. In fact, we wonder how anyone can afford to buy at these prices and sell finished leather at impossibly low prices."

Apps make it happen

The company's sourcing director, Levent Yaman, has a background in logistics and one of the innovations he has brought to the tannery is a sophisticated stock management system in which everything is controlled by



From management to labour, the company has a big team spirit which helps communication and also produce better leather.

smart phone making it, he says, error-free and paper-free. Department heads send him a message requesting authorisation to place an order. If he approves it, his phone automatically generates an email to the supplier and an entry on the enterprise resource planning system for the company's purchasing department.

Supplier relationships matter deeply to him and he has a clear idea of the attributes that set good suppliers of machinery or chemicals apart and the key to maintaining a positive relationship with these suppliers. "If we ask something, the good ones answer quickly and give a good answer," he says. "If you have to ask three times, it's usually no good."

Specific to chemicals, Sepiciler gives a programme to suppliers for each year, revising it monthly and sending out orders as far in advance as possible in the way described above. And yet sometimes it still finds it difficult to get the products it needs. "We say to them that we will guarantee to buy each quarter," Mr Yaman explains, "and ask them to keep the products we are going to need in stock. We have a purchasing contract with them, which I think protects us and the supplier because it stipulates the quality, price and minimum logistics time. We also have a rebate agreement based on annual turnover with our suppliers that promotes a win-win relationship for both sides."

Machinery takes a substantial amount of planning, he admits. Quality is important, but so are service levels and logistics (whether for new machines or parts or other consumables). Sepiciler attempts to

meet its main suppliers, who are based in Italy, every three months to discuss service and delivery issues.

Two paths

According to Mehmet Sepici, tanners today have a choice of following one of two different paths. For price and efficiency reasons, they can choose to buy lower quality hides and skins and tan them to the best of their ability. Then, if they can apply high levels of skill and technology in their finishing departments, with excellent embossing or even hand-painting and ideas of that kind (he refers to it as "a lot of make-up"), they can produce a quality product and command a good price for it.

The second alternative is to try to source the best-quality raw material, bearing in mind that it can be difficult to find good quality and good availability at the same time. "It's also the case that quality changes all the time, even with hides from the same place," he continues. "You have to work very hard and you have to be a good tanner, but if you can find them, you can produce really good leather."

To keep levels of understanding and of appreciation of leather high among the buying public, he believes that labelling is very important. He sees that tanners have a role to play in "training the public" to distinguish between leather and synthetic substitutes, especially in the face of the success some manufacturers of manmade materials have had in imitating leather, including making their products smell like leather. "Leather is valuable, but it's rare," he says. "And hides and skins will become



From a technical point of view

(3) Solid waste management

[a] GENERAL WASTE

- Raw and fleshed trimmings sold for rendering.
- Limed fleshings are rendered – see section (b).
- Chrome trimmings and splits sold to China.
- Chrome shavings sold for leather board manufacture.
- Vegetable tanned trimmings and waste from cutting sold for leather board.
- Vegetable tanned shavings and buffing dust are composted – see section (c).
- General solid waste – bags, barrels, wood, metal, and electrical – segregated at source and stored for sales if possible or controlled disposal.
- Dewatered sludge from effluent treatment are composted – see section (c).

[b] GREASE RECOVERY FROM LIMED FLESHINGS

All limed fleshings are macerated and heat treated, and the grease/oil extracted and sold for further processing. Some of this refined grease is purchased by Sepiciler and used for hand oiling/waxing of vegetable tanned leathers.

[c] COMPOSTING SOLID WASTE (IN-HOUSE)

All of the organic waste from waste treatment and manufacture is composted on site. This operation started in 2009, being developed by Sepiciler in cooperation with local universities, and has a capacity of 15 tonnes/day.

The waste typically comprises 70-80% dewatered solids at 20-25% dry solids from effluent treatment (screenings, mixed chemical and biological solids), 10% fleshing residues (protein) from grease recovery, with the balance made up with vegetable tanned shavings, grass and green residues from the farm plus occasional horse and cow dung.

In practice the solids are deposited under cover in long rows (windrows), and then mechanically mixed/turned several times for the first day. The windrows are then left for one week for the biological process to become established, and then turned once every three days for three weeks. Turning continues once every three days for the next four weeks, the whole process operating on a two-month cycle. The compost



After removal of sulfides, all of the effluents are mixed together, and then chemically dosed before clarification. The effluent then flows to the activated sludge treatment plant (as shown), where it is retained for two days to biologically reduce the strength of the effluent to approved limits for discharge.



Limed fleshings are delivered to this plant where they are macerated, and then heat rendered and centrifuged to recover high value grease. The cooked protein waste is a valuable component within the on-site composting process. Established in 2004, this is an exemplar plant for other tanneries in Turkey.

more difficult to find. Most people buy shoes these days without being sure if they are buying leather or not. Often they are surprised if you tell them a product isn't made from leather, especially if they have paid a price synonymous with leather."

People policies

The management team at Sepiciler is at pains to point to good relationships with workers' organisations. Recent attempts to establish the Izmir tanning cluster in a new free zone were initially attractive to some companies because one of the stipulations was that, as well as being free from import and export duties, it would also be free

from unions. Progress has been slow on the project and Sepiciler prefers its Torbali location. Respecting and collaborating with the unions is an important part of company policy, Mehmet Sepici says. Furthermore, the senior management team wears overalls for a reason; its members are constantly on the shop floor, discussing and helping to solve problems. "We cannot be away from the tannery workers," Mr Sepici says. "We are always working together, making leather together."

Of the 200 workers at the site, 35% are women, a proportion that has gone down recently because lighter work has become available in the local area in newly

constructed textile factories. Men and women work well together at all levels, the managing director insists.

Relationships with the authorities in the local town, Torbali, and in the wider province of Izmir are also strong. A local vocational training school, for high school students who take a more practical than academic path, has set up an introduction to leather course with the support of Sepiciler. It was the tanning company that trained the teachers to give them the knowledge they needed to deliver the course. This project began five years ago and 15 of the company's current employees are young people who



has a Cr content of 1,500 mg/kg on dry weight, and is used within horticulture blended with other organics generally at 1:3 ratios, or blended to reduce the Cr content to below the limit of 1,000 mg/kg. Trials as a nutrient source and as a conditioning agent continue with the Aegean University Faculty of Agriculture.

(4) Water and environmental management

[a] RAW WATER

The raw water supply is alkaline and high in solids. All of the water used for manufacture is treated by ion exchange.

[b] EFFLUENT TREATMENT

The wastewaters are received in two lines: one line contains lime liquors, alkaline washings and vegetable tanning residues, the second line retanning and acid wastewaters and domestic. Both lines are screened using self cleaning screens and settled. The sulfide-containing line is rescreened into a holding tank for one day aeration, then mixed with the screened wastewaters from the second line and held for homogenisation/balancing tank for one to two days.

The mixed effluent is then pumped at a constant rate for chemical dosing, followed by primary clarification for eight hours. The clarified supernatant then flows by gravity for activated sludge treatment over a two-day period, before secondary clarification and monitored discharge.

The solids from chemical dosing and biological treatment are blended together, then, after mixing with polyelectrolyte, pressed on a belt press to produce a dry cake of moisture content 70-80%.

The capacity of the plant is 1000 m³/day: it is the first ETP in the Turkish leather industry and has been in operation since



As an alternative to landfill or incineration, all of the sludges from the effluent treatment plant, the rendered limed fleshings, and vegetable tanned shavings, with other organic matter are mixed together (as shown) in covered windrows. After two months a compost of high nutrient value is produced.

1989. On average the COD of treated effluent is 250 mg/l against the limit of 300 mg/l, and the Cr content 0.1 mg/l against the limit of 1 mg/l.

[c] EMISSIONS AND ENERGY

All of the emissions from the finishing departments are wet scoured before discharge to the atmosphere. Energy savings have been made by changing from coal to natural gas (in 2005), and by the reduction in drum running times as a result of lime splitting, and the lower floats used during pickling and tanning. ☺

completed this course, and in addition eight students each year spend time in the tannery as interns.

Final thoughts

Many members of the Sepici family are active in the company, staying faithful to the commitment of the first Mehmet Sepici. His grandson and namesake says that being a tanner is more than just a suitable job for members of his family because of the name his grandfather chose, but more because, now, it's in their blood. "If we are still in business, this is one of the most important reasons," he concludes. "But I have to point out that we regard our workers, our technicians, our engineers and all the members of the management team as one family and we work closely together."

He also refers to Sepiciler as "a big school, a training academy for the Turkish leather industry" because everywhere he goes in Turkey to seminars or leather industry events, he meets engineers, technicians and even bosses and managers from other companies who cut their

professional teeth with Sepiciler in Torbali and learned well. Well enough for Dr Yalçın Dikmelik to refer to the company's workers as "organic scanners". What he means is that the leather the company produces passes not just in front of the eyes of the

members of the team, but through their hands too. And like a barcode scanner, these skilled people can immediately take in the qualities and any deficiencies in that particular hide. They know their jobs; they know leather. ☺

Control and accreditation

The laboratory serves the four on-site tanneries and the environmental departments. It provides a full range of physical and chemical analysis using approved equipment and test methods. External analysis, when required, is supported by universities and accredited test houses.

AWARDS

- Environmental Investments & Projects 1995 & 2006.
- 2010 EBSO Environmental Award (composting).

