



Water-repellent and metal-free leathers

The OakLeather range of leathers manufactured by the Carvalhos Group in Portugal's principal leather manufacturing cluster, Alcanena, are metal-free, based on wet white tanning systems, and incorporate tannins extracted from the bark of oak trees. The original development work commenced around 10 years ago and was focused on the automotive sector. However, the range has now expanded to other uses such as leathers for furniture, leathers for shoe uppers and linings.

The demand for metal-free leather has increased with requests from makers of shoes for babies up to three months old and for toddlers of up to three years. This followed concerns that small children often put their feet (and shoes) in their mouths, making metal-free options attractive to concerned parents. The use of OakLeather (the name Carvalho means 'oak' in Portuguese) in footwear has since extended into adult footwear.

More recently the product range has expanded in two stages:

- 1] A leather that is designed to be completely biodegradable once an article has reached the end of its useful life. This breakdown is complete within a period of two months under normal conditions of moisture and temperature as found within landfill, and in accordance with the conditions of ISO 20200-2004. Known as BiOnature this product was developed by the Carvalhos Group through joint investigations with the faculty of science and technology (FCT) of the Universidade NOVA de Lisboa, and the leather and shoe technological centres CTIC in Alcanena and CTC, France.^[Legend 1]
- 2] More recently, the project has expanded to make a leather within the same family that is water-repellent and remains

metal-free. This has been called HydroOak and was initially aimed at the outdoor footwear industry such as hiking, mountain walking, sailing and golf activities, although interest has been shown from both the leathers for furniture and clothing sectors too. Extensive tests have shown that these leathers will withstand:

- More than 420 minutes of flexes using the Bally Penetrometer (crank motion 15%, and visual end point), with a water uptake of 13.2% at this time.
- More than 25,000 cycles using the Maeser Penetrometer (alarm for end point), with a water absorption of 8.2% at that time.

These results have been verified by CTIC, the parameters being tested across several analyses with excellent repeatability and confirmation that these leathers are chrome-, heavy metal- and CFC-free.

Technological advantages within leather manufacture

- These new leathers offer distinct environmental advantages. For the consumer the leathers meet all of the parameters normally expected such as colour- and light-fastness and smoothness of grain surface, while remaining within the same price range as chrome-tanned or wet white leathers.
- Within manufacture advantages include: raw material from fresh Iberian hides that have been preserved by cold storage and without any use of preserving agents, meaning a reduced level of salinity for ultimate discharge, and the option for high-grade use of both fleshings and trimmings.
- One of the main advantages that is offered within manufacture of these leathers is the absence of any chromium-



based products. This avoids the separation of chrome-containing wastewaters for subsequent treatment, simplifies the management of effluent treatment and solids disposal, and therefore reduces costs. Another advantage is that solid waste products from manufacture are metal free, and this enables their use as a component of fertilisers.

- At the same time all of the dyestuffs used are metal free, and the finishing systems water-based thus simplifying the treatment of emissions.
- A change in drying operations inside the Carvalhos tannery has taken place. Vacuum driers are no longer used in making these new leathers and this results in considerable energy savings. The leathers are suspension-dried using on-line pole conveyors that circulate in the roof areas of the finishing department. This requires a longer drying time, but utilises the heat from the finish drying cabinets.

Different technology has been used with the HydrOak leather as chromium is not used within either the tanning or the waterproofing process. In this case, within the scope of a metal-free leather making process, products were identified and incorporated within wet processing to link and maintain waterproofing agents within the fibre structure to create an effective barrier to water penetration and uptake.

Legend

Legend 1: Couro Azul, part of the Carvalhos Group of tanneries participated as a Tannery of the Year finalist and was profiled in World Leather December/January 2013/14.



Carvalhos has added water-repellent leather to its OakLeather metal-free range. CREDIT: CARVALHOS GROUP

Composting under laboratory conditions of Bionature leathers (Test method ISO 20200:2004)

Day 0



The shoe was produced using only biodegradable components. The uppers and linings were made from BiOnature leathers.

Day 7



In the laboratory test, after seven days the shoe shows colour fading and degradation of the fibre structure. This compares to similar breakdown in 17 days under natural composting conditions.

Day 14



After 14 days the degradation of the leather structure in the laboratory tests is profound. This compares to similar breakdown in 31 days under natural composting conditions.

Day 21



After 21 days in the laboratory tests the shoe has totally disintegrated. This compares to similar breakdown in 2 months under natural composting conditions.