

DNA traceability of hides and leather

Applied DNA Sciences (ADNAS) and Eurofins BLC Leather Technology Centre last year completed a successful research project to develop a comprehensive traceability platform for leather. The organisations are now working together on the commercial implementation of this system.

It has been just over two years since a provider of DNA-based product authentication solutions, and Northampton-based Eurofins BLC Leather Technology signed a research agreement to develop a traceability platform for leather. In May last year, they claimed success for the project, stating that there was scope for it to be implemented across the entire leather supply chain.

The scope of the initial feasibility project was:

- Synthesis of DNA markers for animal skin and leather;
- Compatibility trials of DNA markers with leather manufacturing process conditions;
- Investigation into the use of the DNA markers and their subsequent recovery at the farm, abattoir, wet blue stage, finishing plant and finished product manufacturer.

At the end of last year, the two organisations signed an agreement to work on the commercial implementation of the system, based on Applied DNA's SigNature T technology, which has already been applied to cotton, wool and synthetic textiles.

At the time, Adam Hughes, managing director of Eurofins BLC Leather Technology, said there was "a strong need" for a system of traceability for semi-processed and finished leather. He described the system that has been developed as cost-effective and said it allows for the application of "a unique molecular tag in a way that is impossible to counterfeit".

The Applied DNA SigNature molecular tags are based on the use of short, unmodified DNA molecules generated biochemically by large-scale polymerase chain reaction (PCR) processes.

They are synthesised from the standard DNA building blocks to create unique and secure DNA taggants that can be authenticated using simple, portable in-field testing methods.

The company's aim now is to have 300 million square feet of DNA-tagged leather under contract over the next five years. This could be achieved through partnerships with project sponsors and other tanneries. Among the initial sponsors was the Scottish Leather Group. Nicholas Muirhead, managing director of Muirhead Leather, part of SLG, was involved in the bulk trials. "Traceability in our manufacturing process is already robust," he says, "and we consider ourselves industry leaders in this regard. Giving the customer the option of using advanced DNA tagging allows them to build in more confidence in their own manufacturing streams."

World Leather spoke to Tony Benson, ADNAS managing director for the EMEA region, to find out more about the project.

Q: How did Applied DNA Sciences become involved in this project?

A: We were initially contacted by BLC regarding leather traceability. Looking at the chemicals that were involved in the leather making process, we were a little sceptical at first but after various conversations we decided that we would give it a shot. Our plan of approach was to concentrate on chrome-tanned bovine shoe upper leather and to mark up an animal on the farm and track it all the way through to the final product. We certainly managed this within the trial work carried out at the pilot tannery at BLC and now look to scale it up.

Q: Are there multiple tagging phases?

A: Yes. Depending on exactly what the client is looking for, the DNA tag can be added at various stages. The application can be put on at the farm to trace from farm to tannery; at the tannery to trace between tannages; and at the finishing plant or even in the finishing process itself. It was clear early on that DNA tagging on the hair of the animal was soon lost after the unhairing process. This was more a physical issue rather than the degradation of the DNA itself, but traceability was detected between farm and slaughterhouse. In the tanning phase, the DNA penetrates the hides and is detectable in both the grain leather and the subsequent wet blue split.



CREDIT: SARA WINTER / SHUTTERSTOCK



Q. How do you ensure cross-contamination isn't an issue?

A. The amount of material we use in the DNA tagging was calculated very precisely. In the pilot project we spent a lot of time getting the dosing right to hit the 'sweet spot' for having the right amount present without excess causing issues of possible cross-contamination. In terms of volume, we are working with parts per billion so for the leather industry we must bulk out the product so that application in the processing vessel is practical. Rather than using a pipette we provide about a litre of product.

Q. How do you ensure that the tag remains intact through the tanning process?

A. DNA by its very nature is quite robust. This was a concern but through addition at the right stages, the DNA is able to withstand the processing conditions.

Q. Is the objective still to track from farm to finished product?

A. This is totally down to the discretion of the client. We didn't find too many clients that wanted traceability back to the farm but to determine the wet blue split origin was quite a common request. Understanding the reasons for wanting traceability is key and for most people it's about minimising risk. If we did want to track the animal through the entire process, then one of the best ways would be to use an ear tag impregnated with the DNA as well. Conventional ear tags can be removed and copied but the DNA is unique and in absolutely no way can it be reproduced.

Q. Once you have the finished product, how can you trace back to the farm or the tannery?

A. The detection of the DNA tag is quite straightforward. The leather is swabbed and then this swab is placed in a detector. After about 30 minutes, the analysis is complete and is displayed graphically to show whether the DNA has been detected. It's totally usable in the operating environment and non-destructive. The data from the tagging analysis is also uploaded to a database and we can gather information from



Tony Benson, Applied DNA Sciences managing director for the Europe, Middle East and Africa (EMEA) region.

around the world. So, for any given product, testing throughout the process allows for a 'molecular certificate' to be generated which can identify the location of the test carried out, the DNA code that has been issued and the machine that was used. This allows us to provide the customer with traceability.

Q. Are you ready to go to market with the product?

A. Yes, we are ready for business and are in a position to sell. All the trials in the pilot-scale tannery at BLC proved the scope and we have done some commercial-sized work at the sponsor tanneries to demonstrate that it works in that environment too. There's still a little bit of technical work to do and we are pulling together the commercial side of it all as well. 🌐

French leather and footwear research and testing body CTC is in the final stages of developing its own traceability solution, this time using carbon dioxide (CO₂) lasers to mark a unique code on the hide. It is carrying out this work in partnership with tanneries and abattoirs.



two-dimensional data matrix code with up to 14 characters. The label can be identified using a specialist barcode reader. Since April 2017, it has tested more than 6,000 skins at three slaughterhouses.

The non-contact marking of the hides/skins takes into account the uneven nature of the material. It takes less than two seconds for 14 characters to be marked. Reading of the identifier, which takes place at the acquisition station, is automated using decoding software that can be installed on a computer. Trials have shown a successful read rate of more than 95%. In the case of the alphanumeric marking, any loss of information can be manually input into the system.

The next phase of the pilot will include industrialisation of the system and miniaturisation of the reading equipment.

Cattle identification is widely carried out through the application of ear tags containing information about birth department, breeder number, and the animal's own identifier. This compulsory traceability format is in place in the majority of European countries and is a matter of food safety. At the point of slaughter, the individual identifier is linked to a slaughter number specific to that slaughterhouse. This stays with the carcass, although the identification is not carried over to the hide.

CTC has undertaken a CO₂ laser marking pilot. This allows for the skins to be labelled with either a one-dimensional barcode or a