Spectrum

Less pollution, and a useful by-product

To turn a hide into leather, the first thing a tannery has to do is remove the hair. This isn't difficult; a soaking in a liquor made up mainly of lime and sodium sulfide does the trick. The problem is to prevent the removed hair constituting a pollution hazard.

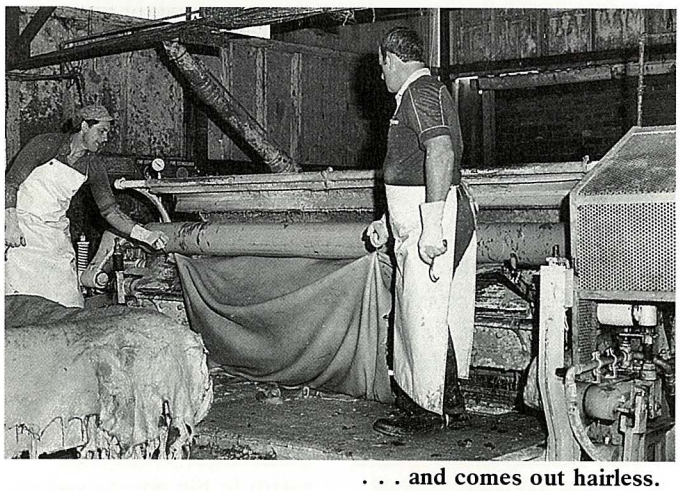
Comprising degraded protein, the hair forms a particularly unpleasant component of a tannery's effluent. With large biological and chemical oxygen demands, it has a prodigious ability to make water foul by removing dissolved oxygen. In fact, about 80% of the polluting potential of tannery effluent derives from the hair-removal process.

Currently, tanneries screen and precipitate the protein, along with some other components, out of the effluent. They then remove as much as possible of the resulting sludge from the effluent before it enters the sewers.

Achieving a satisfactory degree of sludge removal is difficult and expensive. And the quantities are very large: sludge production from a tannery can approach 50 000 L a week. Normally it is dumped on land.

Clearly, the hair presents quite a problem. But it doesn't need to. If it could be readily recovered intact, or in a partially degraded form, it would be a marketable commodity. It could be utilized as a fibre, or as a source of proteins or amino acids (for example, it could supply the cystine used in bread-making).

A hide with loosened hair goes into an unhairing machine . . .



. . . and comes out hairless.

In the United States of America some tanneries have already found it worth their while to recover the hair, despite the fact that existing non-destructive removal methods are both slow (they can take weeks to detach the hair from a hide) and costly.

Research aimed at developing a rapid, inexpensive, hair-recovery system has been in progress around the world for many years. Systems utilizing enzymes looked attractive, but have not lived up to their promise because of adverse effects on leather quality.

Now a new method, being developed in the Leather Research Group at the CSIRO Division of Protein Chemistry by Dr Jim Scroggie, Mr Robin Cranston, and Mrs Margaret Davis, looks promising. Involving only relatively simple modifications to the conventional lime–sulfide hair-destroying process, it takes just 3–4 hours to remove the hair essentially intact.

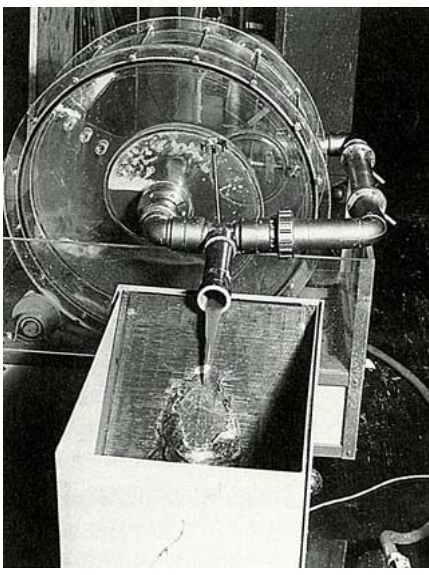
In the conventional process, hides are soaked in a highly alkaline solution containing sodium sulfide and lime. This degrades the hair protein, allowing removal of the hair in a 'pulped' form.

The first step in the CSIRO team's hair-removal method is a soaking for the hides in sodium hydrosulfide alone. Without lime, the liquor has a much lower pH, and the hair remains intact. The soaking continues until the solution has diffused thoroughly into the hair follicles.

Then the hide is washed in a solution (for example, calcium hypochlorite) that removes hydrosulfide from the 'external' hair on the hide. This wash is too brief to allow the solution to penetrate the follicles, which remain impregnated with hydrosulfide, but virtually none of the chemical stays on the external hair.

Next, the hides are soaked in a lime solution. The pH of the hydrosulfide left in the follicles increases, with the result that the hair is dislodged from the hide. But as it is exposed only to lime, not to sulfide as well, the bulk of the hair remains intact.

Once this hair has been removed, normal treatment of the hides continues. First, any remaining hair is destroyed chemically, and finally the hide undergoes the normal tanning process that turns it into leather.



A pilot-scale drum that allows continuous removal and recirculation of processing liquor for screening out loosened hair.

Dr Scroggie and his colleagues have tested their process in many trials, finding out how changes to the processing conditions affect the result. The trials have dealt successfully with hide loads of up to 600 kg, and the scientists expect

soon to begin trials at a full commercial scale.

Their general aim is to come up with a process that: causes rapid and virtually complete unhairing; recovers the bulk of the hair essentially intact; involves only minimum modification to existing technology; and produces leather at least comparable in quality with conventionally produced leather.

Modern tanneries do all their processing in large rotating drums. Bundles of hides go in raw and come out chrome-tanned; the different liquors needed for the various steps in the process are pumped in and out as required.

In their trials so far, the scientists have found that the hair can be removed largely intact without emptying the hides out of the drum after their hydrosulfide and lime soaks. It is washed out with the liquor and caught on wire screens. Whether this will prove possible in a commercial-scale operation, however, is one of the main questions still to be answered.

If it doesn't, the hides could be 'dropped' from the drum after the hair has been loosened. An unhairing machine would scrape it off, and then the hides would go back to the drum for further processing.

As its main drawback, this method of hair removal would have an increased labour requirement. It would have advantages, though. Surface defects would be visible on the hairless hides, so inferior hides could be sorted out then instead of at the end of tanning. Also, hides could be split at this early stage to give the thickness required in the final product.

The team's hair-removal trials have left hides with a particularly clean grain. These have produced good leather, with feel and other properties similar to those of the conventionally processed product.

The commercial future of the process in Australia's 40 or so tanneries will depend partly on the development of markets for the removed hair. If potential buyers want the hair for its physical characteristics, processing conditions will have to be adjusted to ensure that it remains intact. On the other hand, if they are interested in it as a source of protein or amino acids it would only be necessary to ensure that the hair retains its essential chemical nature.

However, the main advantage of the process is its ability to alleviate the pollution-control problems that tanneries have to cope with. It greatly reduces the difficulties and costs involved in purifying the liquid effluent to acceptable standards. And the sludge-disposal problem virtually disappears.

Development of a hair-recovery process for unhairing of hides. R.W. Cranston and J.G. Scroggie. *Australian Leather Journal*, 1982, 85, 2–4.