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Artificially induced collagen fibril orientation affects tear propagation in leather

Ovine leather has around half the strength of bovine leather and is therefore not suitable for high value applications such as shoes. For leather from a variety of animals it has been found that the extent of collagen fibril alignment (orientation index) is closely correlated with the strength of the leather. We tested whether biaxial stretching for the duration of tanning or compressing pickled pelts prior to tanning the ovine skins could increase the orientation index of the collagen fibrils and the strength of the final product.

Control and test ovine skins were tanned using conventional chrome tanning methods. After the pickling and bating the test skins were compressed between rollers before tanning or stretched biaxially during the tanning process. The stretch was applied was between 2.3%, 10% and 15% of the pickled pelts original length; either uniformly (10% and 10%) in both directions or with 2.3% in one direction and 7.5% in the other. Tear strengths were measured by standard methods in two directions, normal to one another relative to the backbone of the skin. Collagen fibril orientation was measured using synchrotron based small angle X-ray scattering, both edge on to the leather and flat on to the leather.

The in-plane collagen fibril orientation index rose from ca. 0.45 to ca. 0.70 both with compression with rollers and biaxial stretching. With non-uniform biaxial stretching there was an increase in the flat-on orientation index. Tear strengths are affected by both the in-plane fibril orientation. Tear propagation is resisted by collagen fibrils arranged at right angles to the tear front but propagates more readily along the direction of fibril.

While it was possible to increase the collagen fibril orientation, this lead to direction specific tear strength increase rather than an overall increase in the skins tear strength, which has a more complex but rational behaviour.

Keywords or phrases (comma separated)

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Yes

What is your gender?

Female

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