Australian Synchrotron
USER MEETING 2014
20 – 21 November
National Centre for Synchrotron Science

Contribution ID : **7** Type : **Poster**

Changes to the Nanostructure of Collagen in Skin During Leather Processing

Thursday, 20 November 2014 17:30 (90)

Leather is a complex biomaterial largely composed of collagen fibrils. As skins are processed to produce leather, chemical and physical changes take place that affect the physical properties of the material. The structural foundation of these changes at the collagen fibril level is not fully understood and formed the basis of this investigation. Synchrotron-based small-angle X-ray scattering was used to quantify fibril orientation and D-spacing through eight stages of processing from fresh green ovine skins to staked dry crust leather. Both these structural aspects were found to change with processing. At a higher pH, both D-spacing and the fibril orientation index are lower. The elastic modulus also changes with high salt concentrations and low pH conditions associated with materials that have a low elastic modulus. This study shows that there are structural changes taking place during the processing of skin to leather. It is proposed the change in D-spacing is due to pH affecting the H-bonding within the tropocollagen unit and the decrease in OI is due to the relaxation of tension in the fibrils enabling the collagen fibrils to bend or distort more. This understanding informs the influence of the chemistry at different stages of processing on the development of the final physical characteristics of leather. By understanding the structural changes of collagen that occur when skin is subjected to chemical and mechanical treatments, it may be possible to modify some of these processing steps to alter the final properties of leather.

Keywords or phrases (comma separated)

collagen, SAXS, leather, structure

Summary

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Session Classification : Welcome Function, Poster Session, Exhibition

Track Classification : Soft Matter