

Microfocus X-ray Scattering Study into the Effects of Liming on the Nano Structure of Collagen

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Abstract: The manufacture of parchment from animal skin involves processes that remove hair, fats, and other macromolecules. It is well understood that the collagen fibres “open up” during processing, which has been quantitatively measured previously by this group using Wide and Small angle X-ray diffraction.

However, these techniques were transmission experiments, which gave average measurements as the beam passed through the entire hide depth. This study utilises the small beam sizes available from the Microfocus station at the European Synchrotron Radiation Facility in Grenoble, France, to observe nano-structural changes to collagen that occur throughout the hide depth by observing diffraction images at 10 micron steps penetrating into the hide.

The objective was to determine if the previously observed nano-structural changes to collagen and non collagenous materials induced by liming of animal hide were uniform throughout the hide depth. The experimental set-up was designed to observe the collagen axial step between the amino acids, the intermolecular spacing between the collagen molecules in the lateral direction and the scatter observed from disordered materials.

The collagen axial step was observed to be 0.286 nm and the Lateral spacing was 1.2 nm confirming previous studies and was also found to be consistent throughout the hide depth. The observed scatter resulting from the ordered collagen lateral packing was compared with the disordered scatter to determine the collagen/amorphous ratio, which can be used to determine changes in collagen structural integrity. The collagen/amorphous ratio did not change throughout the hide depth, indicating that the collagen structural integrity for the treated animal hide was uniform.

Key words: collagen; X-ray scattering; microfocus; liming; hide