

SAXS Study on Pig Cornea

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Introduction

Cornea, which is the out most protective layer of tissue in the eye that is transparent to visible light.[1] It consists of several physiologically different layers.[2] Its most voluminous component is the corneal stroma (90 %) which itself is also comprised of numerous sheets or layers of highly organized collagen fibrils, lamella. Within each layer, a cross-linked mucopolysaccharide matrix that fills the interfibrillar space surrounds the collagen fibrils. Clinically, one index corneal function or dysfunction is the degree of corneal swelling, and the concomitant loss of transparency. It is important, therefore, not only scientifically but also clinically to investigate the change in the properties of cornea during the dehydration process.

Experimental

Enucleated pig corneas with 11-mm diameter were investigated up to 12 h post mortem. The epithelial and endothelial cells were removed by scraping with a surgical blade, and the cornea was excised from the intact globe. The tissue was placed in distilled and de-ionized water and was allowed to swell.

The SAXS profiles of the swollen and dehydrated cornea at 25°C are shown in Figure 1. The dehydrated cornea shows seven clear reflections, which appeared almost same spacing (0.0094 \AA^{-1}). The reflection observed at 0.057 \AA^{-1} is considered to be the 6th order peak of the collagen fiber. The appearance of the reflections indicates that the bundles of the collagen fibers are fully extended one dimensionally from limbus to limbus. Strong intensities of the 6th, 9th and 11th order peaks may correspond to the distribution of the amino acid residues, within the periodical structure, in which the periodicity, D , is found to be about 640 \AA . This periodicity corresponds to the length shown in Figure 1. Collagen fibers are staggered arrays of tropocollagen molecules, in which successive 1D periods would contain one each of five tropocollagen segments and one $0.6D$ gap. In the case of the swollen cornea, the periodicity, D , is found to be 730 \AA . It is worthy to note that 1st and 3rd order peaks are not clearly observed, which are generally observed in collagen fiber with strong scattering intensities and a relative intensive scattering in low q -region ($q < 0.05 \text{ \AA}^{-1}$). This would be related to the domain structure and/or packing of the collagen fiber, which could be developed by the dehydration. More detailed investigation is in progress.

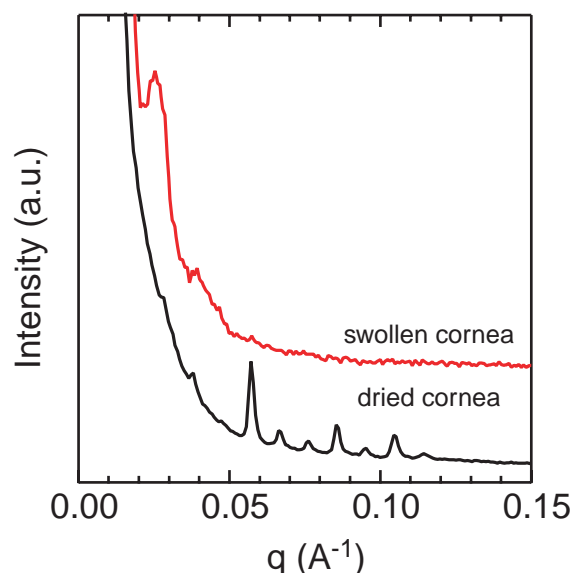


Figure 1: The SAXS profiles of swollen and dehydrated cornea at 25°C.

References

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