

## Rheological characterization of vitreous humour fluid

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The vitreous humour (VH) is a transparent fluid that fills the vitreous cavity in the Human eye. VH occupies a volume of approximately 4 ml and is mainly composed of water (99%) including a network of protein fibrils (collagen) and hyaluronan (1%). It is known that VH becomes progressively liquefied with age, or as a consequence of some diseases, and consequently the rheological, biomechanical and structural properties of the biofluid also change.

The aim of this work is to measure the rheological properties of the VH under shear and extensional flow conditions. VH extracted from New Zealand white rabbit specimens were analysed within 5 hours *post-mortem*. Two different phases were analysed separately: a liquid and a gel phase. The rheological characterisation of the fluids was done using a shear rheometer (DHR-2, TA Instruments) to perform steady shear, small amplitude oscillatory shear (SAOS) and creep measurements. Extensional flow rheological measurements were performed with a capillary break-up extensional rheometer (Haake CaBER1, ThermoElectron).

Results show that VH separates into two different phases (gel and liquid) and both phases exhibit viscoelastic behaviour. The liquid phase rheology is independent of time but the gel properties are time dependent within the time frame of analysis (about 5 hours). The VH liquid phase exhibits a surface tension of 47.8 mN/m, and an average relaxation time of 9.7 ms in extensional flow at physiologic temperature. Both VH phases present higher storage modulus than loss modulus and the measurements performed with VH gel phase 4±1 hours after dissection exhibit the highest moduli values. The compliance results for the gel phase show that it behaves as a viscoelastic gel and the highest compliance values were found for the gel phase right after dissection. The results obtained can be useful to correlate the differences in VH composition during the different phases of the eye's life (liquefaction process) and also the changes in the biofluid as a consequence of some diseases.

Keywords: Vitreous Humour, Rheology, Biorheology.

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