

Rheology of Cholesteryl Liquid Crystals for use as cells adhesion substrate

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INTRODUCTION:

Cholesteryl ester liquid crystals (CELCs) have shown biocompatibility and can support cell adhesion under ligands free conditions¹ without subjecting to the density of the extracellular matrix proteins. Dynamic interactions of cells with liquid crystals formed distinct localised deformation on the liquid crystal film over a few days indicated the flexibility and elasticity of the liquid crystals². Therefore, it is crucial to further characterise the rheology of this material and investigate the effects of shear rate and strain so that the force transducing properties of the CELCs can be characterised.

METHODS: frequency sweep test was conducted by oscillatory shearing the liquid crystals using a rotary rheometer at shear rates from $0.01s^{-1}$ to $10s^{-1}$ at 5% strain. The test was followed by an amplitude sweep test to obtain the stress-strain relationship and effects of shear rate on the physical properties of the liquid crystals. All shearing tests were conducted at $37^{\circ}C$.

RESULTS & DISCUSSION: We found that the liquid crystals have a prevalent linear elastic behavior when the angular frequencies were stepped down below 20% strain at angular frequency below $1s^{-1}$ (Figure 1). Similarly, the stress-strain relationship of the liquid crystals was also dependent on the angular frequencies (Figure 2). The result also indicated that the cholesteryl ester liquid crystals had an elastic modulus approximately $1.3 \times 10^{-3} Pa$ at $0.01s^{-1}$ which is closed to the calculated values³.

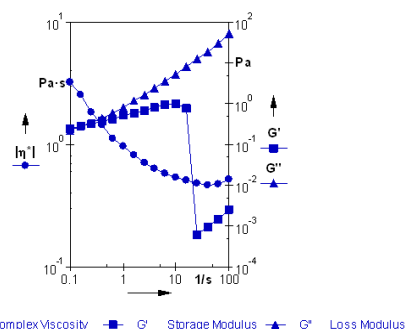


Figure 1: Frequency sweep test result for cholesteryl ester liquid crystals.

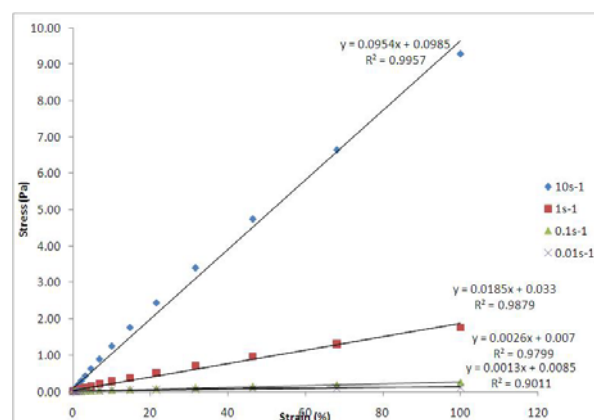


Figure 2: Stress-strain curve of cholesteryl ester liquid crystal and the effects of shear rates.

CONCLUSIONS: Cells move at relatively low speeds, thus the result from the low angular frequencies are more representative of the forces exerted by cells on the CELCs. The determining of these rheological properties at low frequencies will therefore enabled the forces exerted by cells on CELCs to be quantified.

REFERENCES: (1) Soon, C.F., *et al.* Proceedings of World Congress on Engineering, 2009, 2, 1872-1875. (2) Soon, C.F., *et al.* IFBME Proceedings Vol. 25/X, 2009, 9-12. (3) Zapotocky, M., *et al.* Science, 1999, 283(5399), 209-212.