Viscoelastic Properties of Byssal Threads of the *Californianus* Mussel

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**What are byssal threads?**

*Mytilus californianus* readily adhere to many types of materials such as rocks, metals, and wood despite hostile environmental conditions in the intertidal zone. The mussel can achieve this through the byssus, a collection of energy dissipative threads and adhesive plaques. In this work we focus in the byssal threads distal region where we seek to understand their viscoelastic properties. Understanding the relaxation properties will further our understanding on the byssal self-repair process, which may lead to better design principles for synthetic materials.

**Small Angle X-ray Scattering (SAXS)**

*Defines molecular spacing*

![Diagram of X-ray scattering](image)

\[ D - space = \frac{2\pi}{q} \]

In order to connect bulk material properties, such relaxation %, to the molecular level.

**Tensile testing**

Performed in order to characterize mechanical properties such as elastic modulus and stress relaxation.

**Stress relaxation in dry conditions**

Results indicate that the rate of decay is changing with different treatments and a few treatments experience the same amount of relaxation.

**Stress relaxation in wet conditions**

Results indicate that the rate of decay is changing with different treatments and relaxation is treatment dependent.

**Conclusion**

When byssal threads are strained to 10%, the increase in D - space is approximately equal to the bulk strain. We interpret this to mean that the domains flanking the collagen (silk + His-rich) extend at low strains and are responsible for a majority of the stress relaxation.

**References**


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**PreCols with clearly defined modules**

**Marine mussel**

**Byssal threads are deposited individually by a process called injection molding**

**Diffraction pattern - no strain**

**Diffraction pattern - 10% strain**

**1D reduction of 2D diffraction patterns**

**D-space with various treatments**

**Source X-ray Sample Detector**

**1** 1D reduction of 2D diffraction patterns

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