

Shrinkage temperature of bovine pericardium tissue by MICROCALVET ULTRA

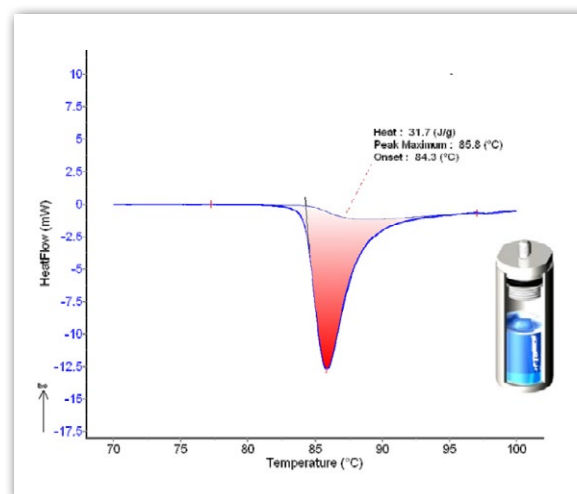
INTRODUCTION

Bovine pericardium, a fibrous tissue enclosing the heart of a cow, is commonly used for heart valve replacement. It possesses excellent hemodynamic properties (the ability to move blood) but lacks the same long-term durability of mechanical valves. Glutaraldehyde stabilizes the collagen structure and increases its durability. The stabilizing effects of cross-linking agents such as glutaraldehyde can be assessed by measuring the shrinkage induced by denaturation of tropocollagen of the tissue. So denaturation temperature (DT) coinciding with a temperature at which the collagen shrinks can be used as a measure of the "shrinkage temperature"(ST).

The goal of this study is to measure the ST change, which reflects the stabilizing effect of glutaraldehyde, and to find correlations with the mechanical testing results.

EXPERIMENT

The MICROCALVET ULTRA used here is well suited for studies of denaturation of proteins. The bovine pericardium sample, stabilized by a proprietary glutaraldehyde fixation process, is provided by an undisclosed bioengineering company. The sample soaked in a saline solution was placed in a standard stainless steel cell of about 1ml. The saline solution was dosed into a reference cell. The DT was measured at a 1 °C /min heating rate which is similar to typical mechanical testing conditions. The enthalpy of denaturation is calculated per gram of dried sample (60 mg).



RESULTS AND CONCLUSION

The DSC thermogram of the bovine pericardium tissue shows an endotherm attributed to denaturation of collagen. The peak maximum temperature is widely accepted to represent the ST. The untreated bovine pericardium tissue is reported to shrink at ~60 °C, while the bovine pericardium sample in this study has a higher temperature of denaturation with an endotherm maximum at 85.8 °C. This is in very good agreement with mechanical measurements that have shown the ST 85-86 °C. In addition the denaturation enthalpy per gram of dried sample is measured 32 J/g. The higher ST demonstrates a stabilizing effect of glutaraldehyde.

INSTRUMENT

MICROCALVET ULTRA

-20 to 170°C



- HIGHEST HEAT MEASUREMENT ACCURACY**
3D sensor based on Peltier elements with Joule effect calibration.
- MODIFIABLE TEMPERATURE CONDITIONS**
for increased flexibility and replication of real life conditions.
- CONVENIENT INTERCHANGEABLE CRUCIBLES AND CELLS**
to perform even the most demanding experiments using one instrument :
 - high pressure (1000bar) and high vacuum
 - pressure measurement and control
 - mixing experiment
- EXTERNAL COUPLING CAPABILITY**
designed to increase your research options including manometry, BET instrumentation, gas analyzers, humidity controllers and gas panels