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Rheology of PhotoGel®-95% DOM at Concentrations 5%, 10%, and 20% with Photoinitiator LAP and a look at Preliminary Results Regarding PhotoGel Rheology at Various Temperatures

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Viscoelastic Performance of PhotoGel®-95% DOM at Concentration 5%, 10%, and 20% with Photoinitiator LAP

Abstract: The following experiment was conducted to determine the viscoelastic behavior of PhotoGel at concentrations 5%, 10%, and 20%. The results can be seen in the graphs below.

PhotoGel® 95% DOM is a methacrylated gelatin (GelMA) that can be photocrosslinked to form hydrogels. Various parameters can be tuned to optimize the gelation kinetics and rheological properties of the 3D hydrogels, including concentration of gelatin, crosslinking time, photoinitiator intensity, etc…For softer hydrogels, evaluate the 50% DOM PhotoGel®.

Materials

Name/Description	Part Number	Lot Number
PhotoGel-95% DOM	5208	8509
LAP	----------	----------

Procedure

Material Preparation

All gel preparation was performed as per the DFU for PhotoGel® on advancedbiomatrix.com. PhotoGel® was solubilized in 1xPBS at 5%, 10%, and 20% concentrations and combined with the photoinitiator LAP at a 0.034% concentration. Each test was run in duplicate.

ElastoSens

For each test ~2 mL of sample was added to the large testing cup. The parameters of the tests were as follows:

- Overall
  - Stiff sample (with a large testing cup).
  - Test duration: ~25min.
  - Time step: 30s.
  - Temp: 20C.
- Stages
  - 1: 5 min at 20C – to allow the sample to equilibrate at 20C.
  - 2: 10 min at 20C with 405 nm light on at 100% intensity (23.9 +/- 2.8 mW/cm^2) – photocrosslinking stage.
  - 3: 5 min at 20C – resting period to observe any aftereffects of the light exposure.

The ElastoSens procedure was fully automated and allowed to run to completion once started.

Results

The individual viscoelasticity curves for the 5%, 10%, and 20% concentrations can be seen below. The final stiffness for the 20% concentration was approximately 2x the maximum of 10% and 10% was approximately 8x the maximum of 5%. Small changes in protein concentration can lead to drastic changes in gelation kinetics and resulting hydrogel strength.

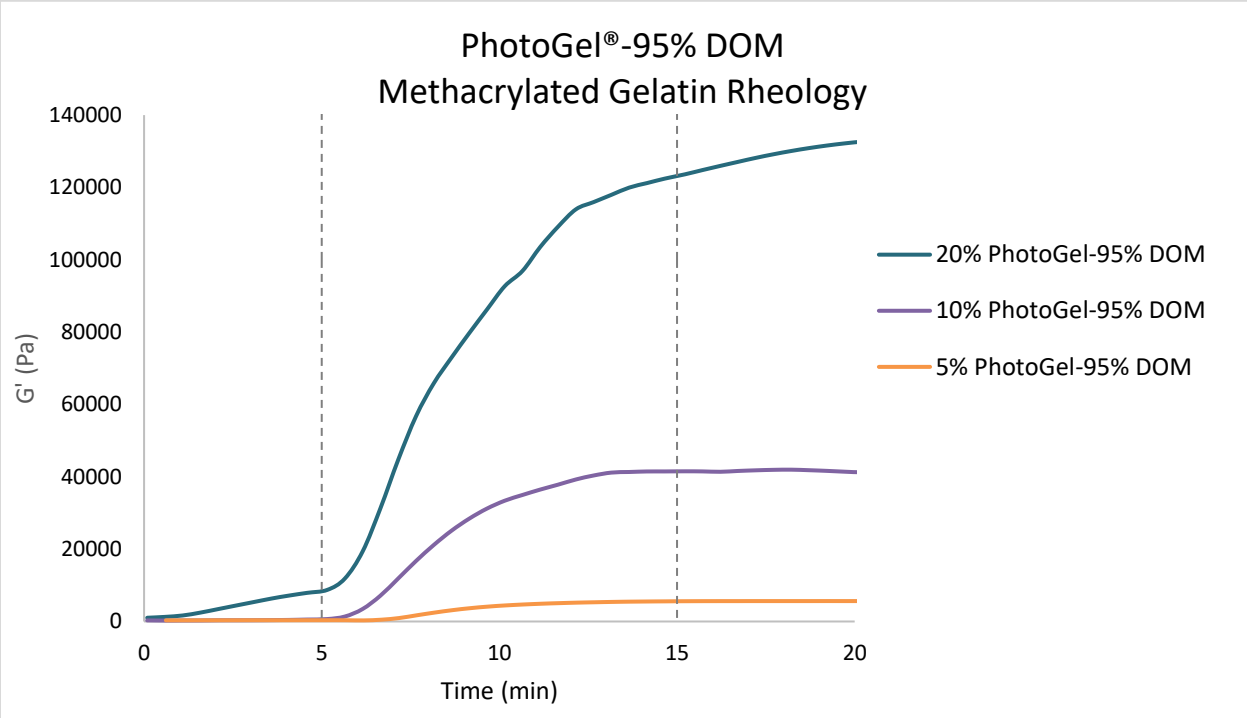

Figure 1. A compilation of the viscoelasticity graphs of PhotoGel at concentrations of 5%, 10%, and 20%. Dashed lines are used to mark the beginning of the 405 nm light exposure at 5 min and the end of that exposure at 15 min.

Preliminary Results Regarding PhotoGel Rheology at Various Temperatures

Preliminary results from the rheology testing of a 10% PhotoGel® (95% DOM) solution at different temperatures can be seen in Figure 2. The protocol followed is the same as outlined above, with the exception that the test was run at 37C rather than 20C. There is a clear difference between the samples, where the colder 20C temperature resulted in the PhotoGel crosslinking to a much higher stiffness of ~40,000 Pa compared to ~9000 Pa of the PhotoGel run at 37C.

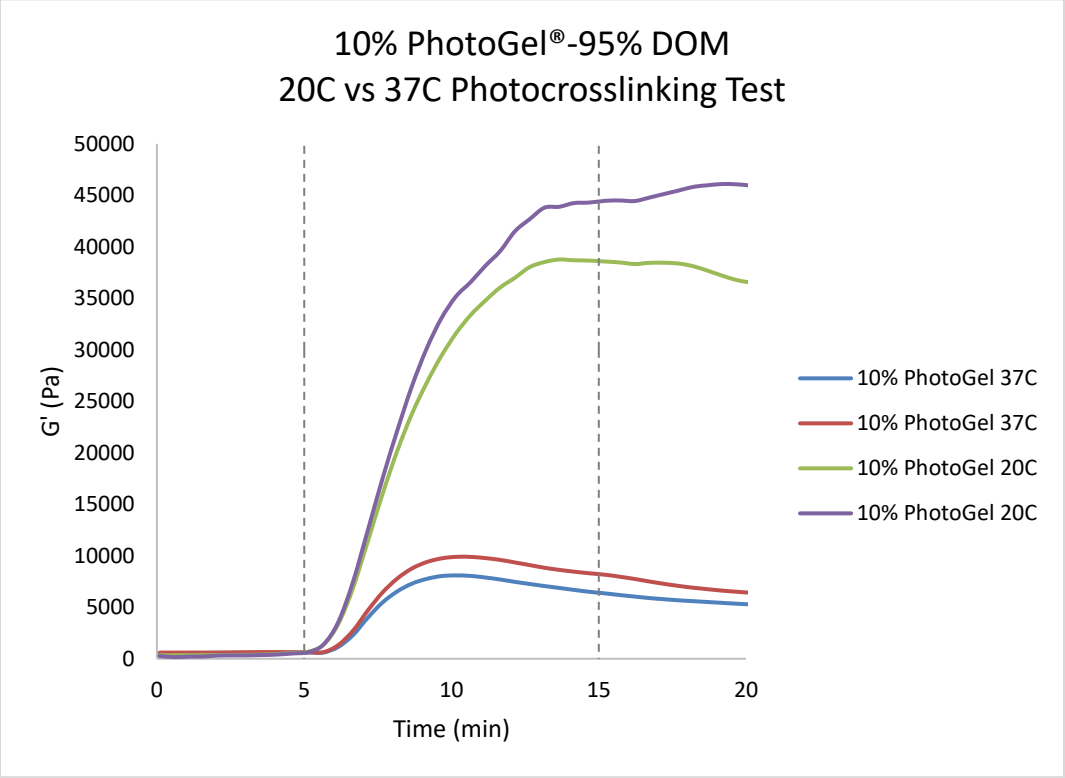

Figure 2. A compilation of the viscoelasticity graphs of 10% PhotoGel at temperatures 37C and 20C. Dashed lines are used to mark the beginning of the 405 nm light exposure at 5 min and the end of that exposure at 15 min.