Rheology of PhotoHA® 1% and 2% with PhotoInitiator LAP

Abstract: The following experiment was conducted to determine the viscoelastic behavior of PhotoHA® at concentrations 1% and 2%, all other parameters remaining equal. The results can be seen in the graphs below.

PhotoHA®-Stiff is a methacrylated hyaluronic acid (HAMA) 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 HA, crosslinking time, photoinitiator intensity, etc… For reference, PhotoHA®-Soft is a glycidyl methacrylate hyaluronic acid (GM-HA).

Materials

Name/Description	Part Number	Lot Number
PhotoHA®	5212	8793
LAP (TCI)	--------	--------

Procedure

Material Preparation

All gel preparation was performed as per the DFU for PhotoHA®-Stiff on advancedbiomatrix.com. PhotoHA® was solubilized in 1x PBS at 1% and 2% concentration and combined with the photoinitiator LAP at a 0.034% concentration. Each test was run in duplicate.

ElastoSens

For each test, ~2g 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: ~25 min.
  - Time step: 1 min.
  - 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: 10 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 viscoelastic graphs of PhotoHA® at 1% and 2% can be seen in Figure 1. While both graphs show similar gelation trends, the final stiffness of the 2% concentration is ~ 4x the stiffness of the 1% concentration. The maximum stiffnesses for all 4 graphs (each concentration run in duplicate) can be seen in Table 1.

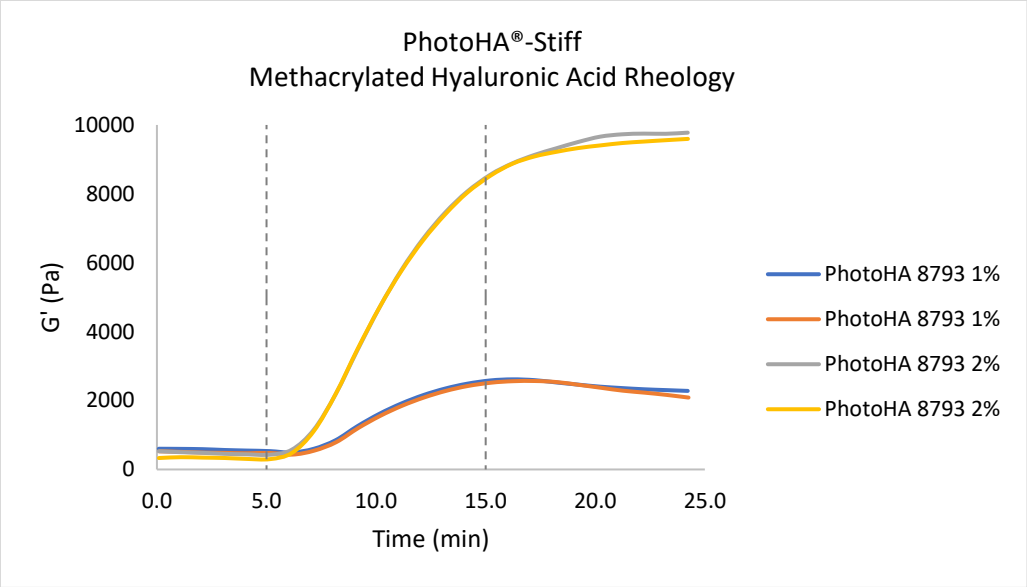

Figure 1. Viscoelastic behavior of PhotoHA® with photo initiator LAP at varying concentrations. 405 nm light was turned on between 5 and 15 min (marked with dashed lines).

Table 1. Maximum shear storage moduli for the PhotoHA® samples pictured in Figure 1 at the concentrations noted below.

PhotoHA 8793 Concentration	Maximum Shear Storage Modulus G' (Pa)
1% - test 1	2615.4
1% - test 2	2567.7
2% - test 1	9776.3
2% - test 2	9595.1