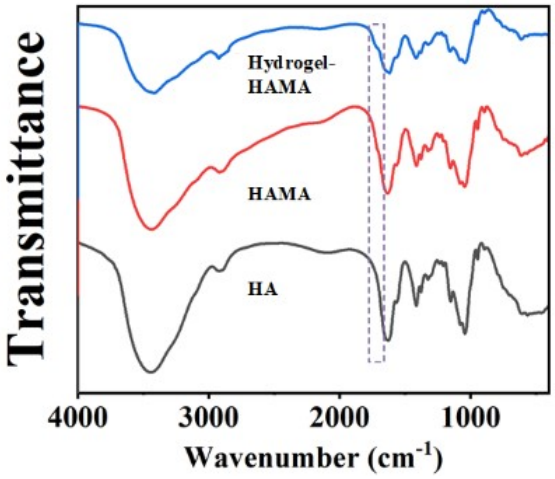

Figure 1. FT-IR spectrum of HA, HAMA and Hydrogel-HAMA

Figure 1 shows the infrared spectral images of HA, HAMA and Hydrogel-HAMA. In the area framed by the rectangle, HAMA, Hydrogel-HAMA has one more inconspicuous infrared peak than HA at the 1720 cm^{-1} wavenumber. The infrared peak was recognized as the stretching vibration of the carbonyl functional group. Combined with ^{1}H NMR for analysis, the methacrylate hyaluronic acid (HAMA) was prepared successfully.

Rheological properties of hydrogels:

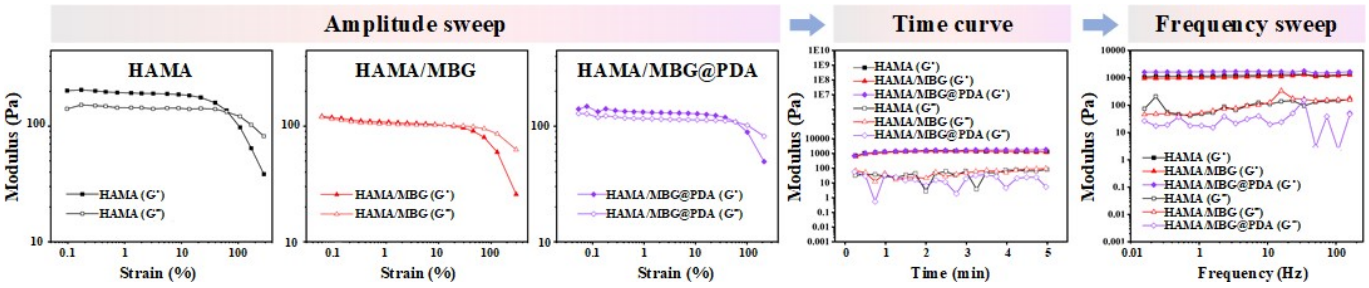

Figure 2. The rheological properties of hydrogels

In addition, in the linear viscoelastic region, the change curve of the performance of the hydrogel precursor with light irradiation over time can explain the change in the internal structure of the material. As shown in the figure 2g, the storage modulus of the hydrogel precursor increases under the illumination condition, indicating that it transitions to the cured state, and then the storage modulus G' tends to balance, indicating that the transition is over. And the subsequent frequency sweep also shows that Hydrogel moulding. The transition end times of the three hydrogels were relatively consistent, indicating that the hydrogel structure was littlle affected.

Variation of pH of hydrogels:

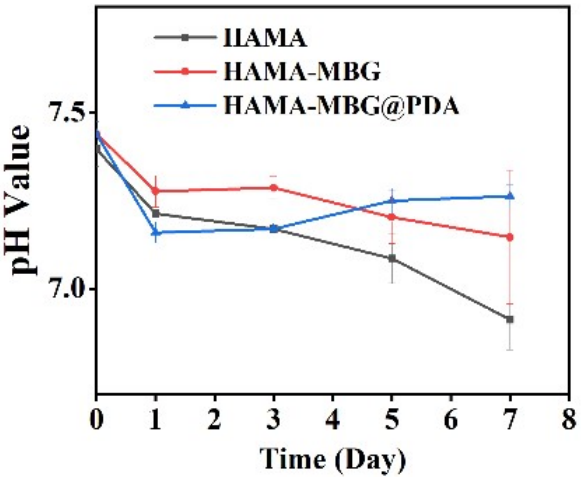

Figure 3. Changes in pH of hydrogels after incorporation of MBG and MBG@PDA

The phenomenon that the pH of the PBS buffer after immersing hydrogels in slowly decreased was discovered (Figure 3). Hyaluronic acid is a natural polymer material with a carboxyl functional group, and the hyaluronic acid solution is weakly acidic because the carboxyl group displays a negative charge. After immerging HAMA hydrogel in PBS buffer for 7 days, the buffer's pH value dropped below 7. However, the pH values of HAMA/MBG and HAMA/MBG@PDA groups' buffer remained above 7. As can be seen from Figure 3d, the pH value of HAMA/MBG@PDA gradually rises from day 3. The release of alkaline ions in the bioglass will affect the pH change of pure HAMA and slow the transition of PBS buffer to a weakly acidic environment. And It can be speculated that the release of alkaline ion Ca^{2+} in HAMA/MBG@PDA is slower than that in MBG.