SMART MCs

PLMA Material Characterisation

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Product Overview

PLMA (Poly-Lysine Methacryloyl) is a light-curable hydrogel derived from methacrylylated poly-lysine, a cationic antimicrobial polypeptide produced by Streptomyces. Through methacrylylation with glycidyl methacrylate, reactive double bonds are introduced, enabling PLMA to be rapidly photocured under visible light. It combines excellent biocompatibility, tunable mechanical properties, and broad-spectrum antibacterial activity, making it well suited for wound dressings, antimicrobial coatings, and bio-ink development

- Fast Gelation cures under visible light in under 10 seconds
- Antimicrobial Properties effective against E. coli, S. aureus, and other common microbes
- Tunable Mechanics supports a range of viscoelastic profiles
- Biocompatible and Degradable safe for biological applications and tissue contact
- Composite Compatibility blends with other hydrogel systems for enhanced performance
- Scalable and Stable ensures consistent quality and processing versatility

1. General Information

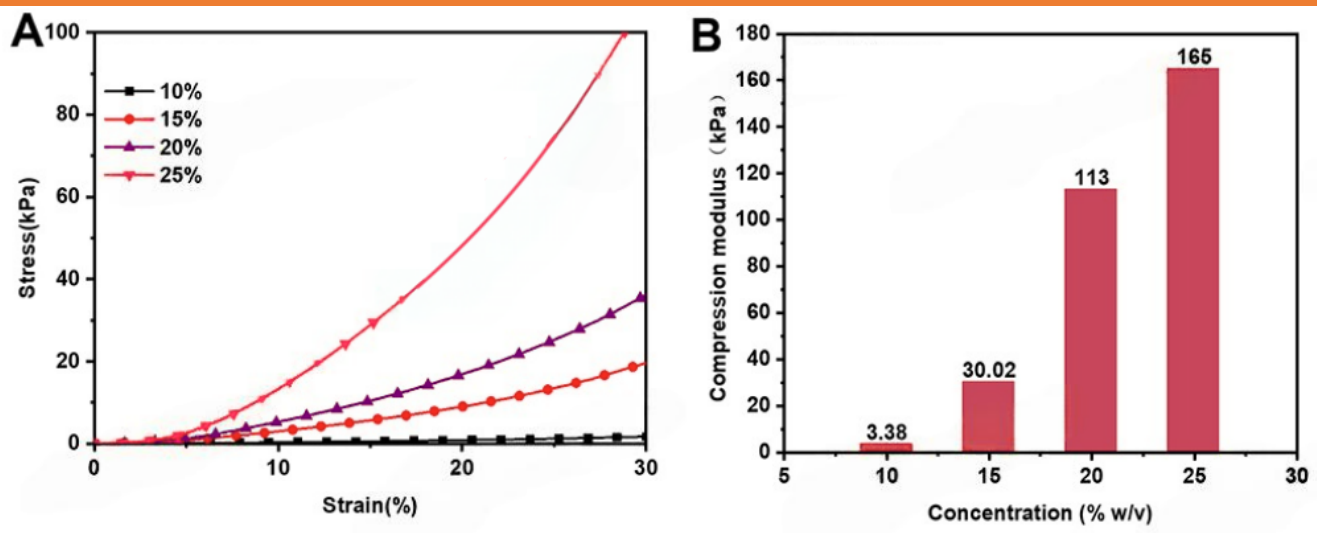
Model	Form	Appearance	Specifications
PLMA	White, sponge-like	White powder	0.5 g/vial, includes 0.025 g LAP photoinitiator

2. Compressive Modulus Comparison

PLMA's compressive strength scales sharply with concentration. Starting at 3.38 kPa (10%), it rises to 165 kPa (25%), making it suitable for both soft and high-load tissue engineering applications.

PLMA Concentration (%)	Compressive Modulus (kPa)
10	3.38
15	30.02
20	113
25	165

Figure 1: Mechanical Properties of PLMA Hydrogel: Compression and Stress–Strain Analysis of PLMA



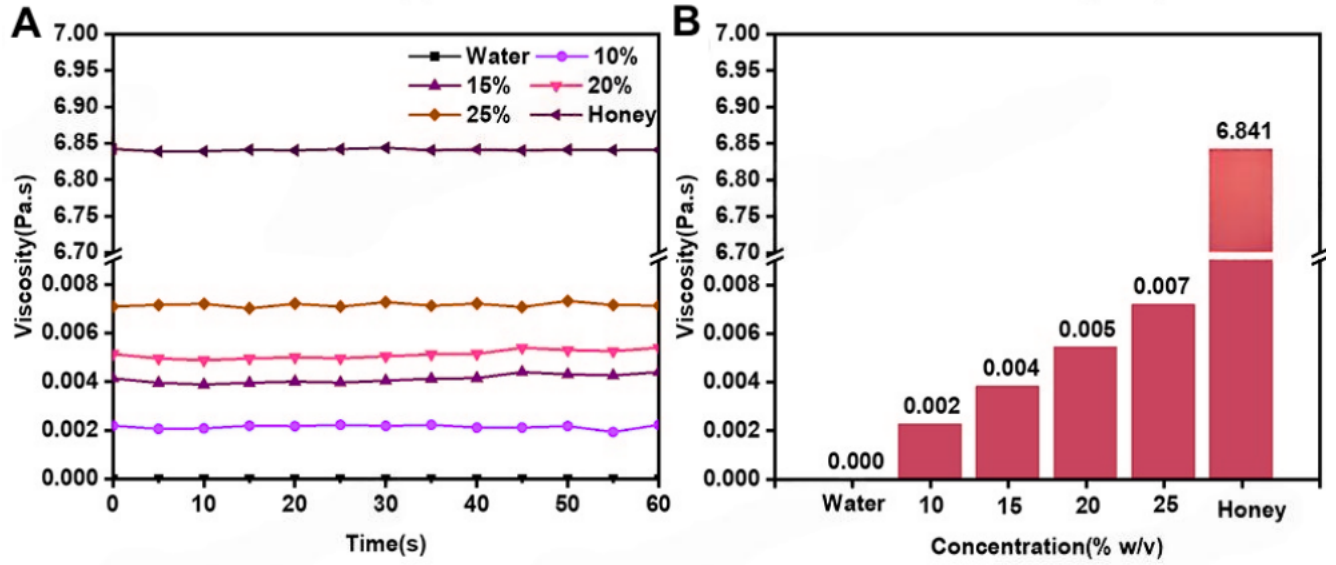
(A) Stress–strain curves across varying concentrations highlight the concentration-dependent mechanical response of PLMA hydrogel.
(B) Corresponding compressive modulus values demonstrate tunable stiffness ranging from 3.38 kPa to 165 kPa depending on formulation

3. Viscosity Comparison

PLMA maintains low viscosity across 10–25% concentrations (0.002–0.007 Pa·s), enabling smooth extrusion and homogenous mixing. Its viscosity remains well below that of viscous standards like honey (~2.6 Pa·s), but higher than water (~0.001 Pa·s), making it suitable for controlled bioprinting and formulation work.

PLMA Concentration (% w/v)	Viscosity (Pa•s)
10	0.002
15	0.004
20	0.006
25	0.007
Honey (control)	6.841
Water (control)	0.000

Figure 2: Viscosity Profile of PLMA



(A) Time-dependent viscosity measurements of PLMA hydrogels demonstrate stable viscosity profiles across all concentrations during the 60-second measurement period

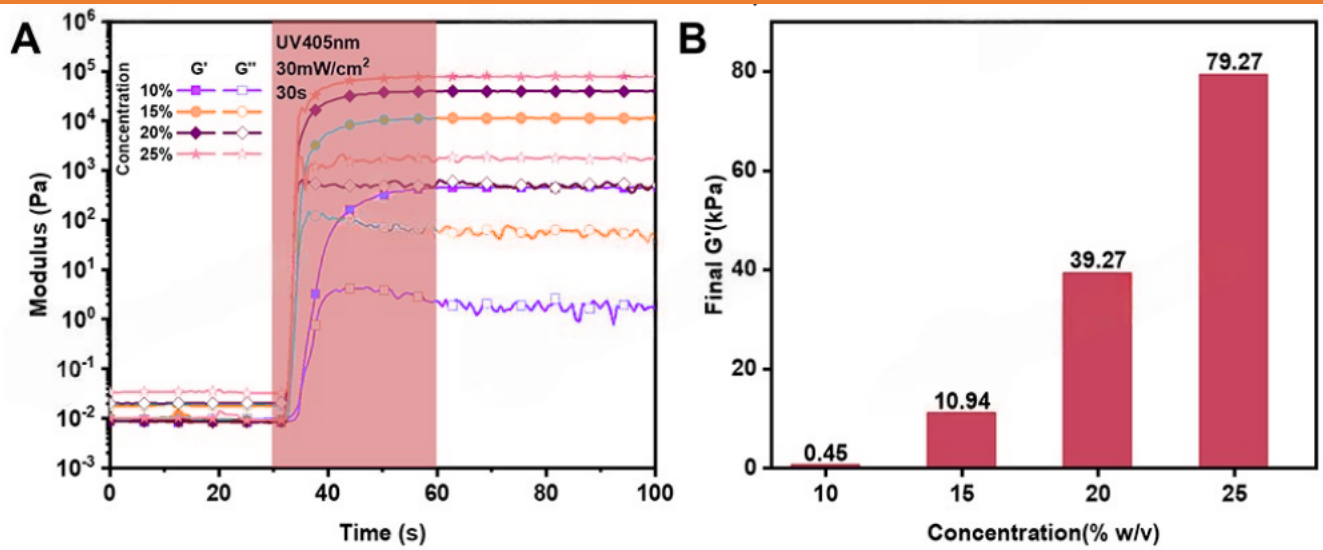
(B) Static viscosity values increase with concentration, confirming the concentration-dependent flow behaviour of PLMA. Water and honey were included as materials for comparison

4. Storage Modulus Comparison

PLMA's storage modulus reflects increasing elasticity post-curing, ranging from 0.45 Pa at 10% to 79.27 Pa at 25%. This tunable stiffness supports structural stability for printed and cast constructs.

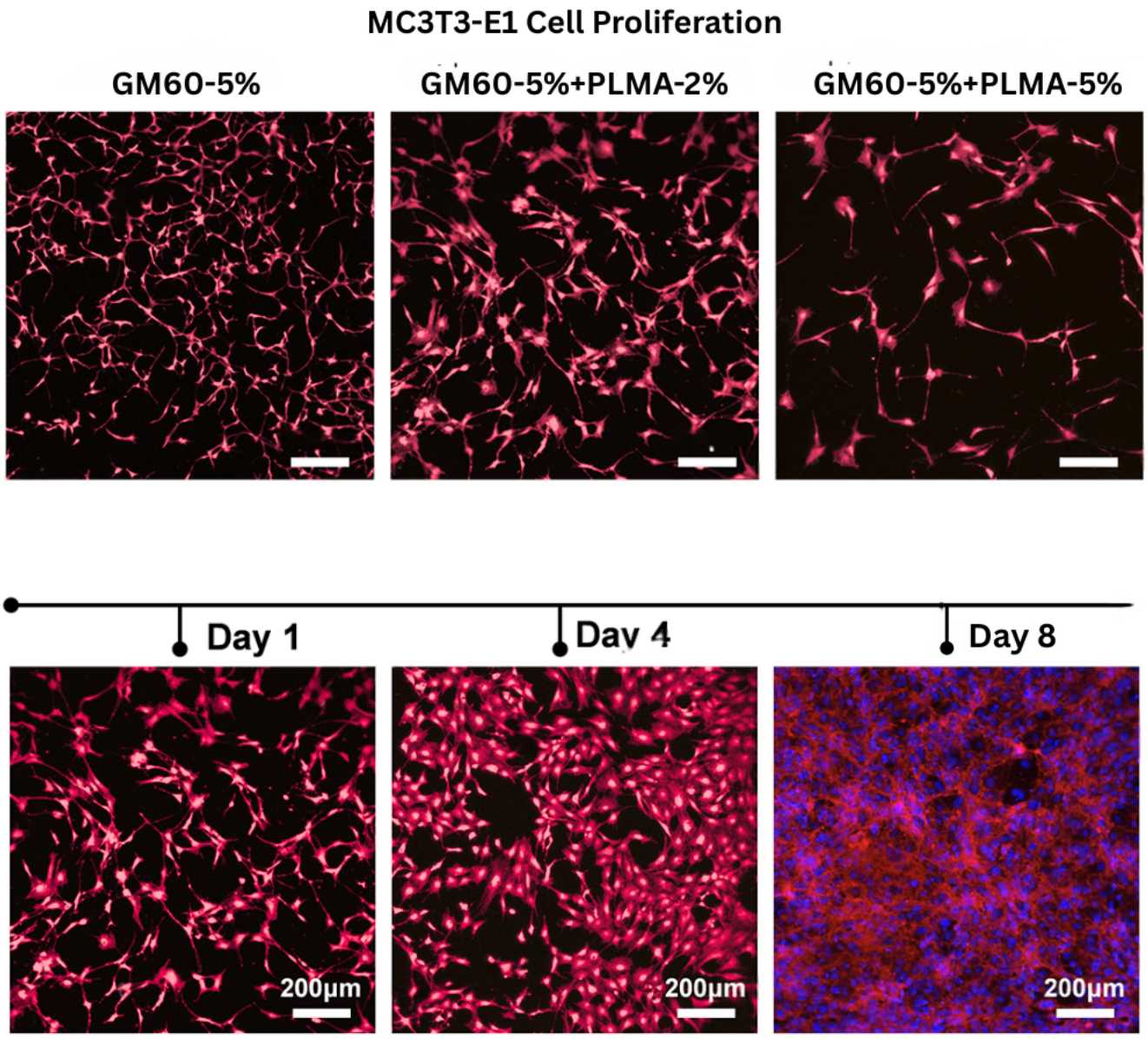
PLMA Concentration (% w/v)	Storage Modulus G' (Pa)
10	0.45
15	10.94
20	39.37
25	79.27

Figure 3. Storage Modulus (G') of PLMA Hydrogel Following Photocuring



(A) Modulus measurements over time show rapid gelation under UV light (405 nm, 30 mW/cm² for 30 seconds)
(B) Final G' values increase with concentration, demonstrating tunable stiffness of PLMA hydrogel

Figure 4. Proliferation and Morphology of MC3T3-E1 Cells on GM60-5% Hydrogels with Varying PLMA Content



Top row: Representative fluorescence images showing MC3T3-E1 cell morphology on GM60-5% hydrogels containing increasing concentrations of PLMA (0%, 2%, and 5%) on Day 1. Cells exhibit enhanced attachment and spreading at 2% PLMA, while higher PLMA content (5%) results in visibly reduced cell density

Bottom row: Time-course images of MC3T3-E1 cells cultured on GM60-5% + PLMA-2% hydrogels from Day 1 to Day 8. Progressive cell proliferation is observed through Day 4, with dense cell coverage. By Day 8, merged fluorescence staining (red and blue) shows extensive cellular activity and viability across hydrogel surface.

Figure 5. PLMA Hydrogel 3D Printing Performance



The printed hexagonal pattern demonstrates the high-resolution shaping capability of the PLMA hydrogel using bio-3D printer. The structure exhibits excellent fidelity and surface definition, highlighting its potential for fabricating customised designs in biomedical applications.