Supporting Information

Synergistic Peptide-Organic Matrix Enhances Mineralization of Biomimetic Scaffold for Bone Regeneration

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Table S1. qRT-PCR target genes and their primer sequences.

Gene	Premier（5'-3')
GAPDH	FORWARD：GCACTGTTGAAGTCGCAGGAGA
	REVERSE：CCGCCCAGAACATCATCCCT
COL I	FORWARD：GGCAAAGAAGGCGGCAAAGG
	REVERSE：GGAGCACCAGCAGGACCATC
Spp 1	FORWARD：CAGAATCTCCTAACACCGCAGAATG
	REVERSE：TGGTCATCGTCCTCATCCTCATC
Runx 2	FORWARD：AGCAGCAGCAGCAACAGCAG
	REVERSE：GCAGCACCGAGCACAGGAAG
BMP2	FORWARD：GCCAGATCAGTCCCTTTG
	REVERSE：TCACGCCGCACAGGTAGG

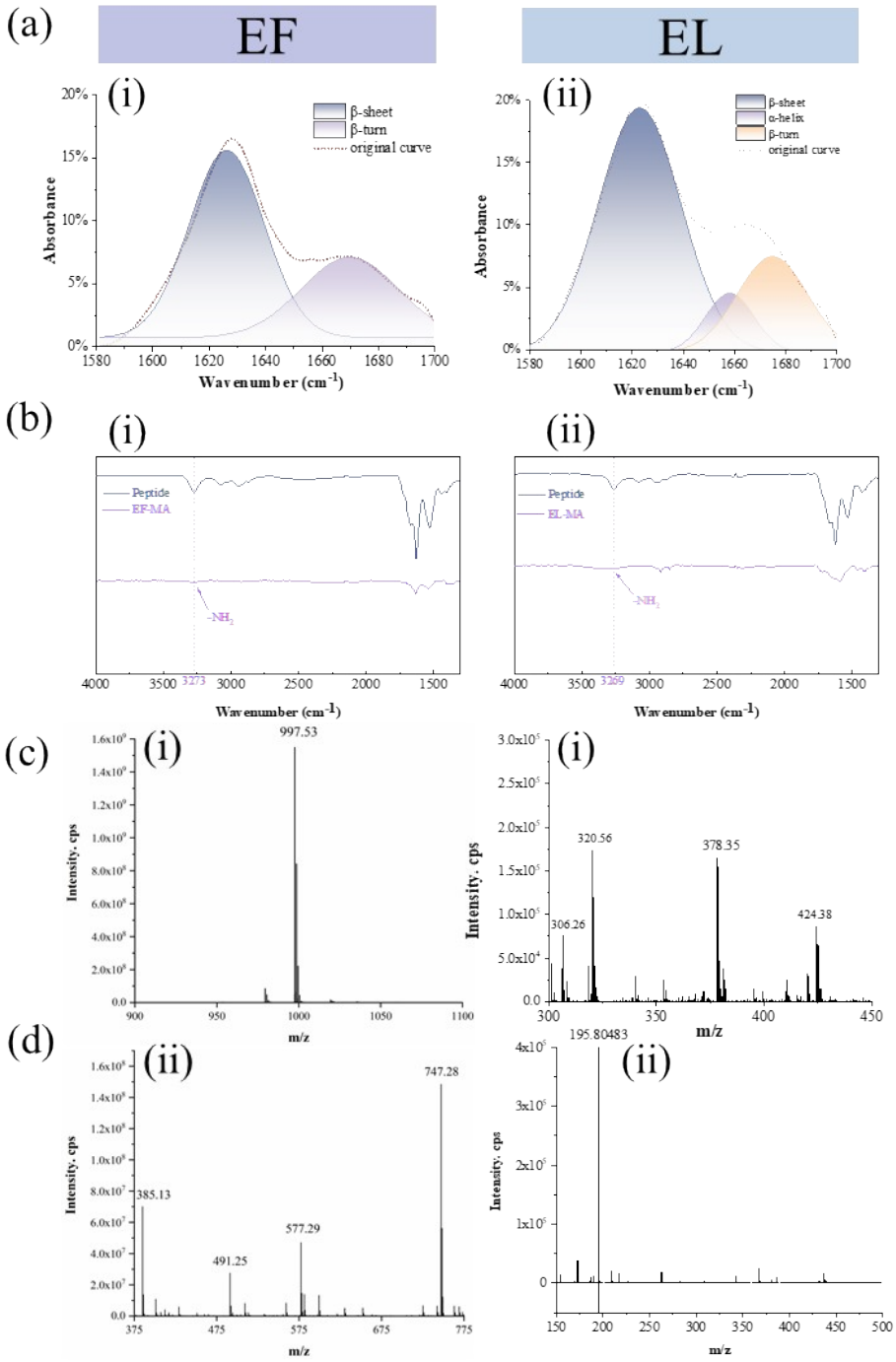

Figure S1. Characterization of basic material preparation. (a) FTIR spectrum of peptide conformation, (i) EF, (ii) EL; (b) FTIR spectrum of peptide and peptide-MA, (i) EF, (ii) EL; (c) ESI-MS spectrum of HG and EE peptide, (i) EF, (ii) EL; (d) ESI-MS spectrum of peptide-MA, (i) EF, (ii) EL.

Table S2. FTIR spectra of conformation results of different sequence peptides

Peptide	α-helix	β-sheet	turn
HGRGEAFDY (HG)	44.81%	54.29%	0.91%
EFKADFKL (EF)	0	65.14%	34.86%
ELRKDDFK (EL)	22.17%	38.22%	32.47%
EEGYRHIC (EE)	0	65.34%	34.66%

SI-1

As shown in Figure S2, only a few scattered mineral particles were present on the surface of GelMA, without a well-defined spherical morphology. These particles were sparsely distributed, covering only a small portion of the field of view. In EF peptide-containing hydrogels, mineral deposition increased with EF peptide concentration. The hydroxyapatite structures became more distinctly spherical and exhibited a tendency to aggregate, primarily along the GelMA ridges. Notably, in the 0.24%-GelMA group, the surface was almost entirely covered with minerals, with spherical particles merging into a layered structure, indicating a significant enhancement in mineralization. Based on these findings, the 0.24%-GelMA group, which demonstrated the most effective mineralization, was selected for further study.

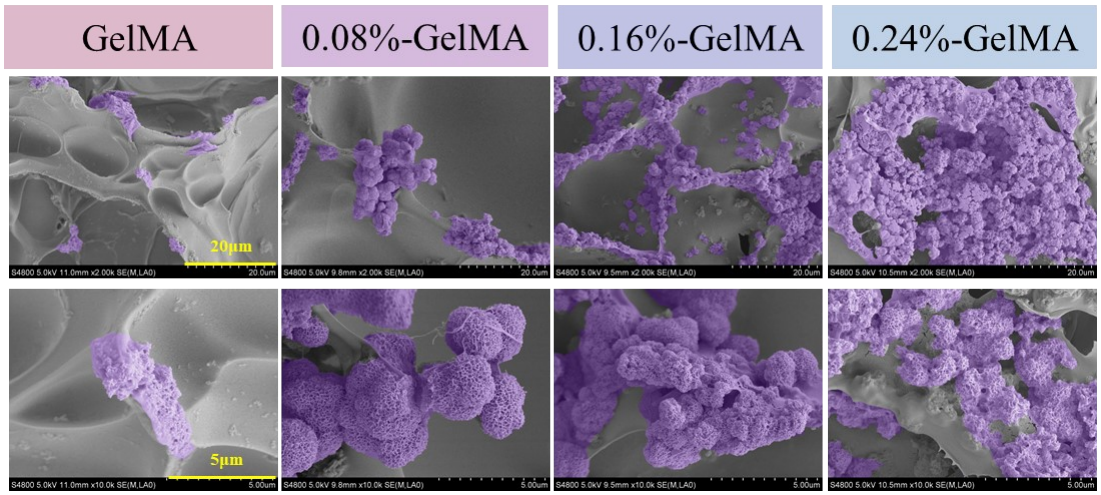

Figure S2. SEM imagine of different peptide-GelMA mineralized in SBF for 1 days respectively.

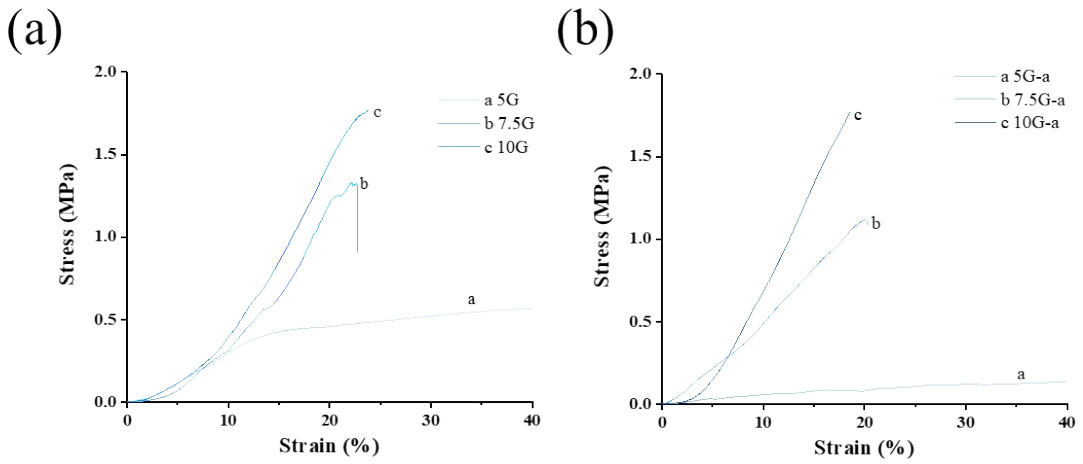

Figure S3. The stress-strain curves of samples. (a) Pure GelMA matrices with varying concentrations; (b) 3 days of enzymatic mineralization with varying concentrations.

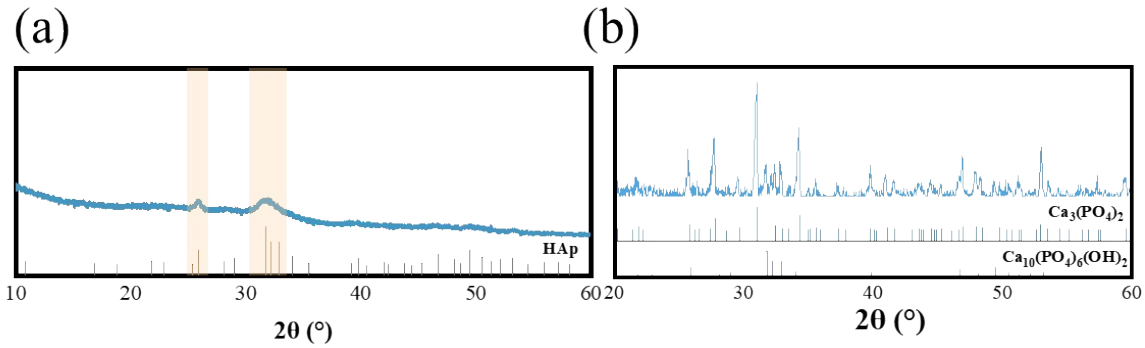

Figure S4. XRD patterns of enzymatic mineralized samples (5G-a). (a) Before sinter; (b) After sinter.

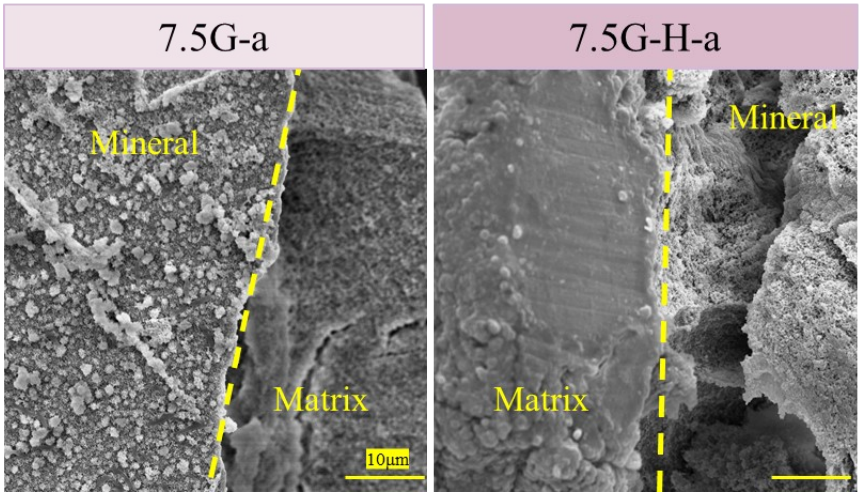

Figure S5. SEM images of hydrogels mineralized for 5 days.

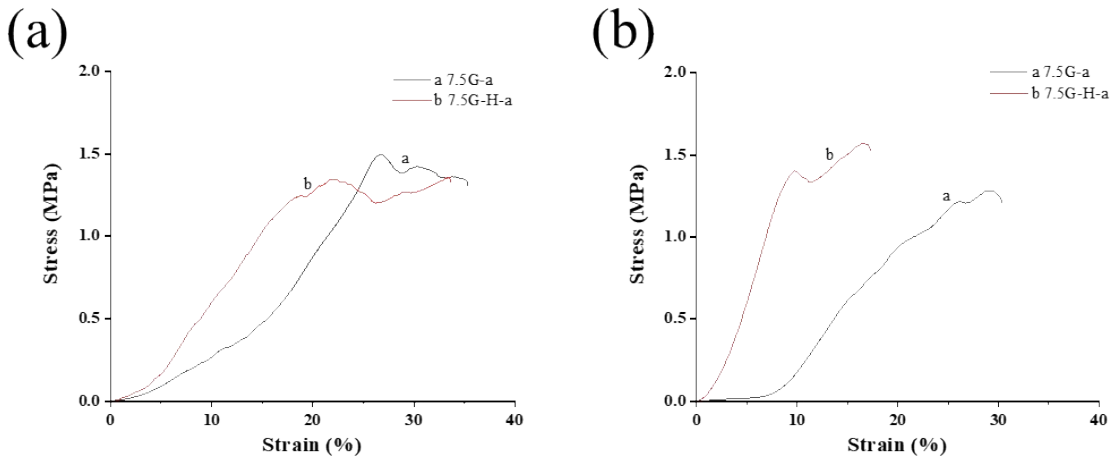

Figure S6. The stress-strain curves of 7.5G-H-a and 7.5G-a samples after mineralization. (a) 3 Days; (b) 5 Days.

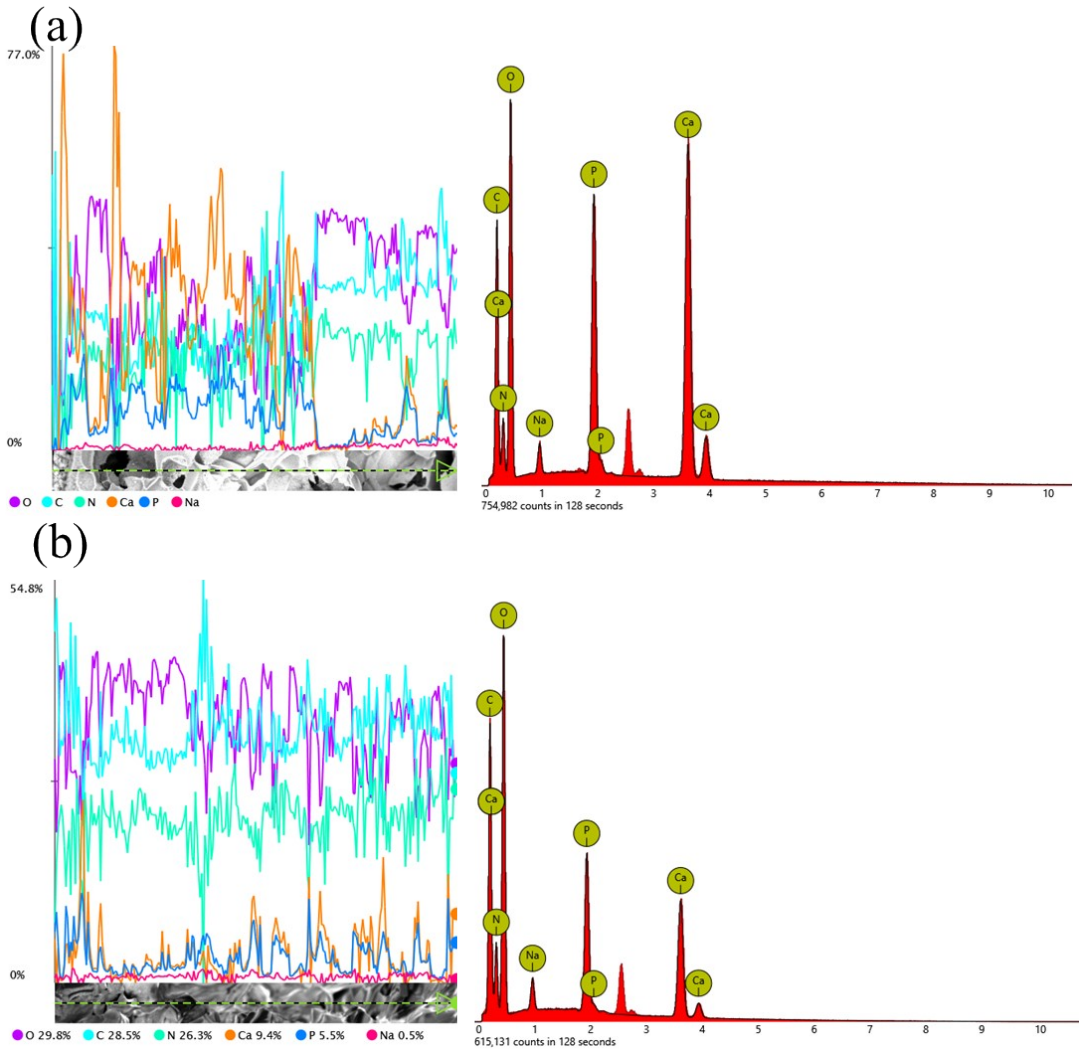

Figure S7.EDS analysis of 5G-H-a; (a)Outer; (b)Inner.

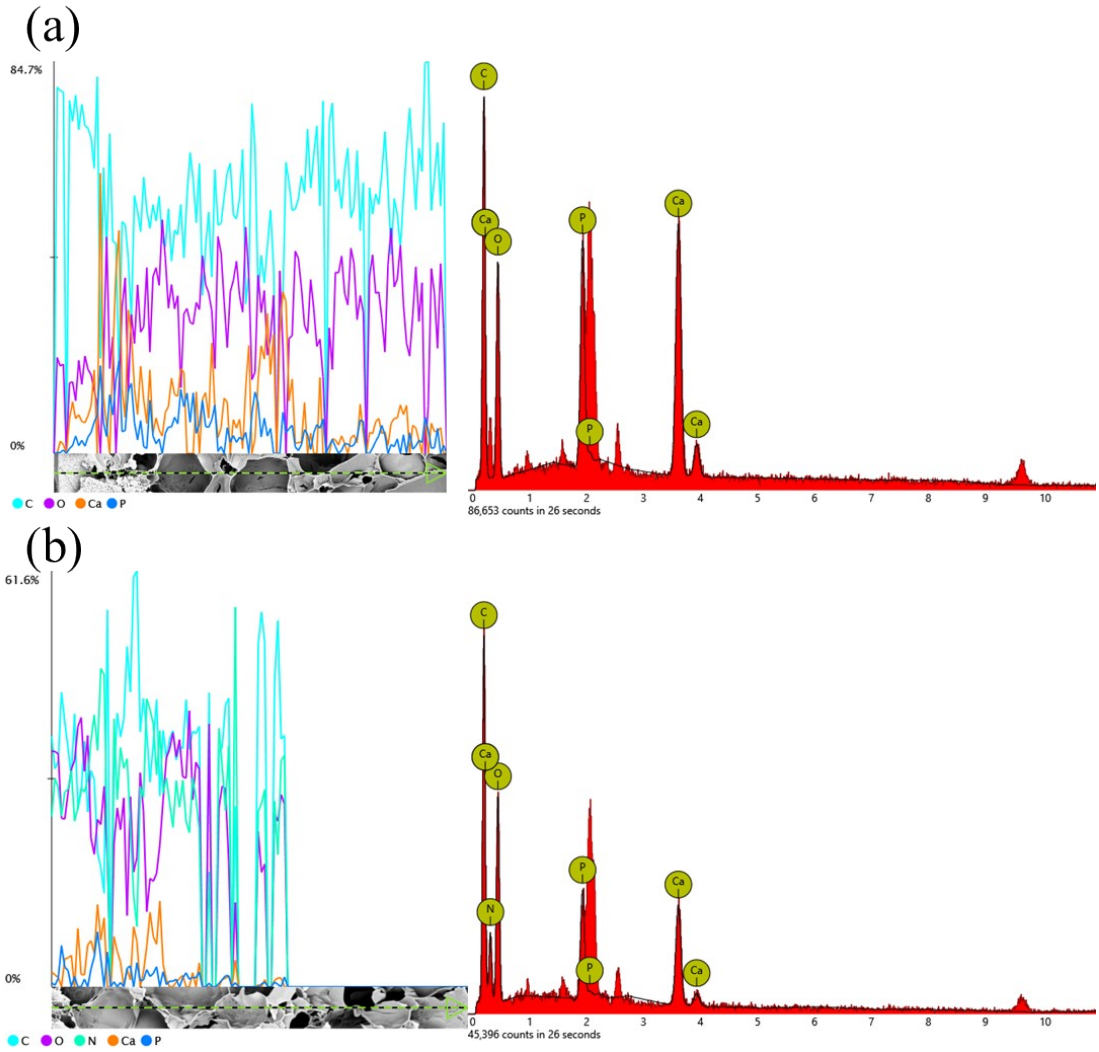

Figure S8.EDS analysis of 7.5G-H-a; (a)Outer; (b)Inner.

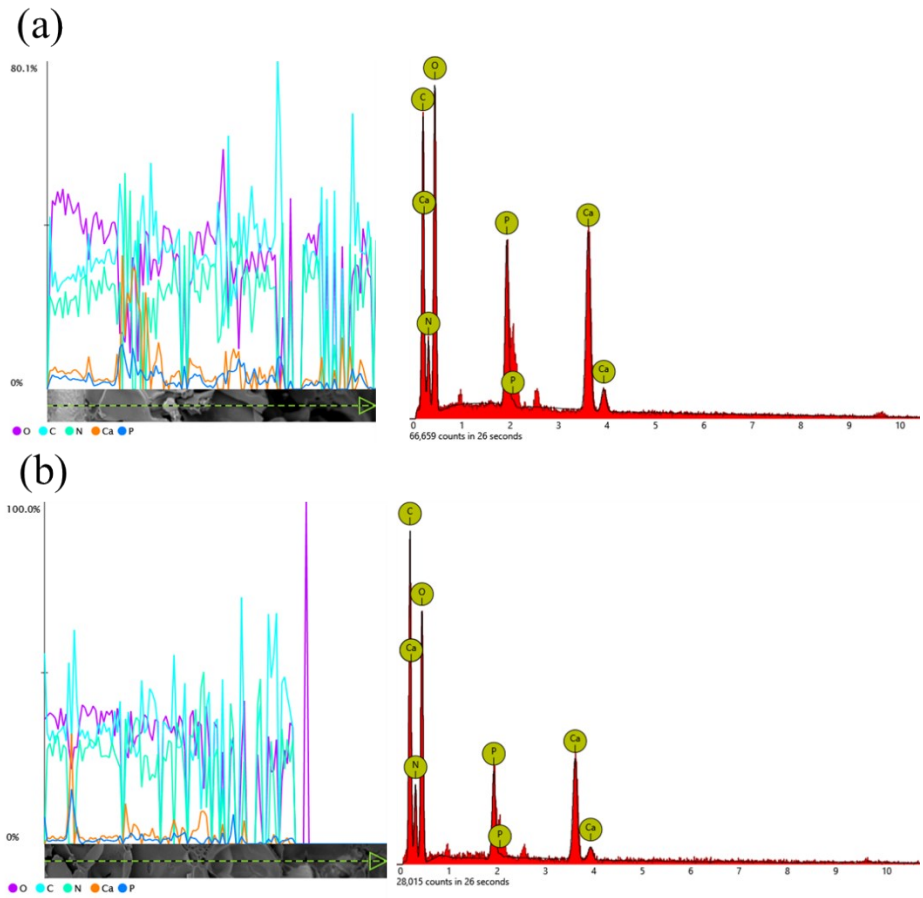

Figure S9.EDS analysis of 10G-H-a; (a)Outer; (b)Inner.

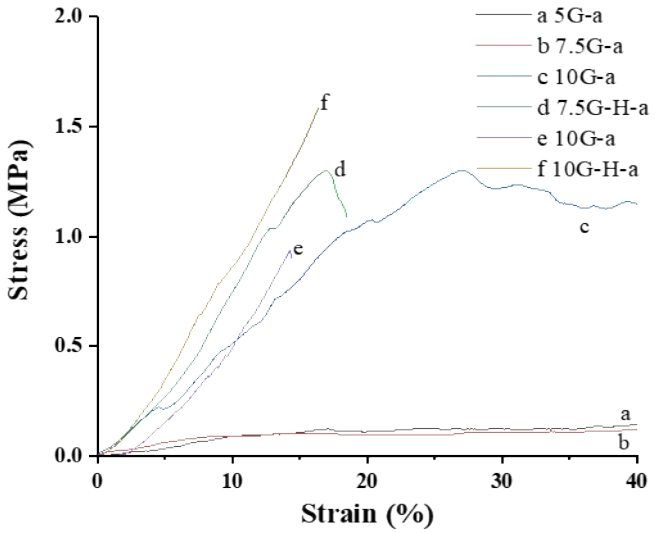

Figure S10. The stress-strain curves of mineralized hydrogels (5G-a, 5G-H-a, 7.5G-a, 7.5G-H-a, 10G-a, 10G-H-a).

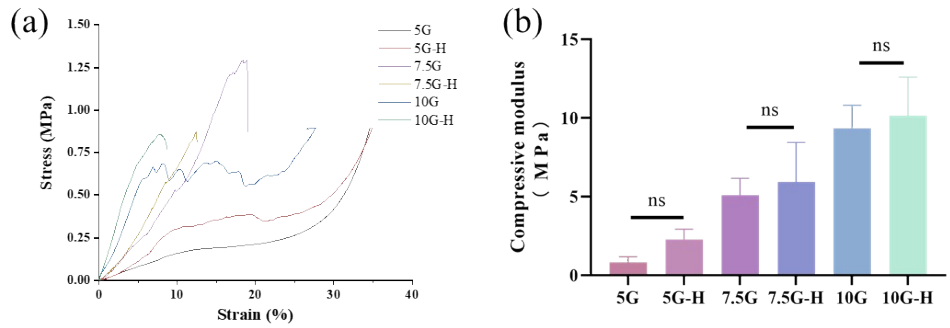

Figure S11. Compressive properties of non-mineralized GelMA hydrogels with or without HG peptide at different concentrations. (a) The stress-strain curves of samples; (b) Compressive modulus of hydrogels.