Supplementary Information (SI) for Biomaterials Science.

Modulating Oxygen Release via Manipulated Microspheres Embedded in Thermoresponsive Hydrogel for Enhanced Stem Cell Survival under Hypoxia

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Nomenclature of CPO microspheres	Gelatin Concentration (wt%)	CaO_2 Concentration (wt%)
A0	10	0
A1	10	1
A3	10	3
A5	10	5
B0	20	0
B1	20	1
B3	20	3
B5	20	5
C0	30	0
C1	30	1
C3	30	3
C5	30	5
D0	40	0
D1	40	1
D3	40	3
D5	40	5

Table S1. The nomenclature of CPO microspheres with their gelatin and CaO_2 concentrations in the fabrication process.

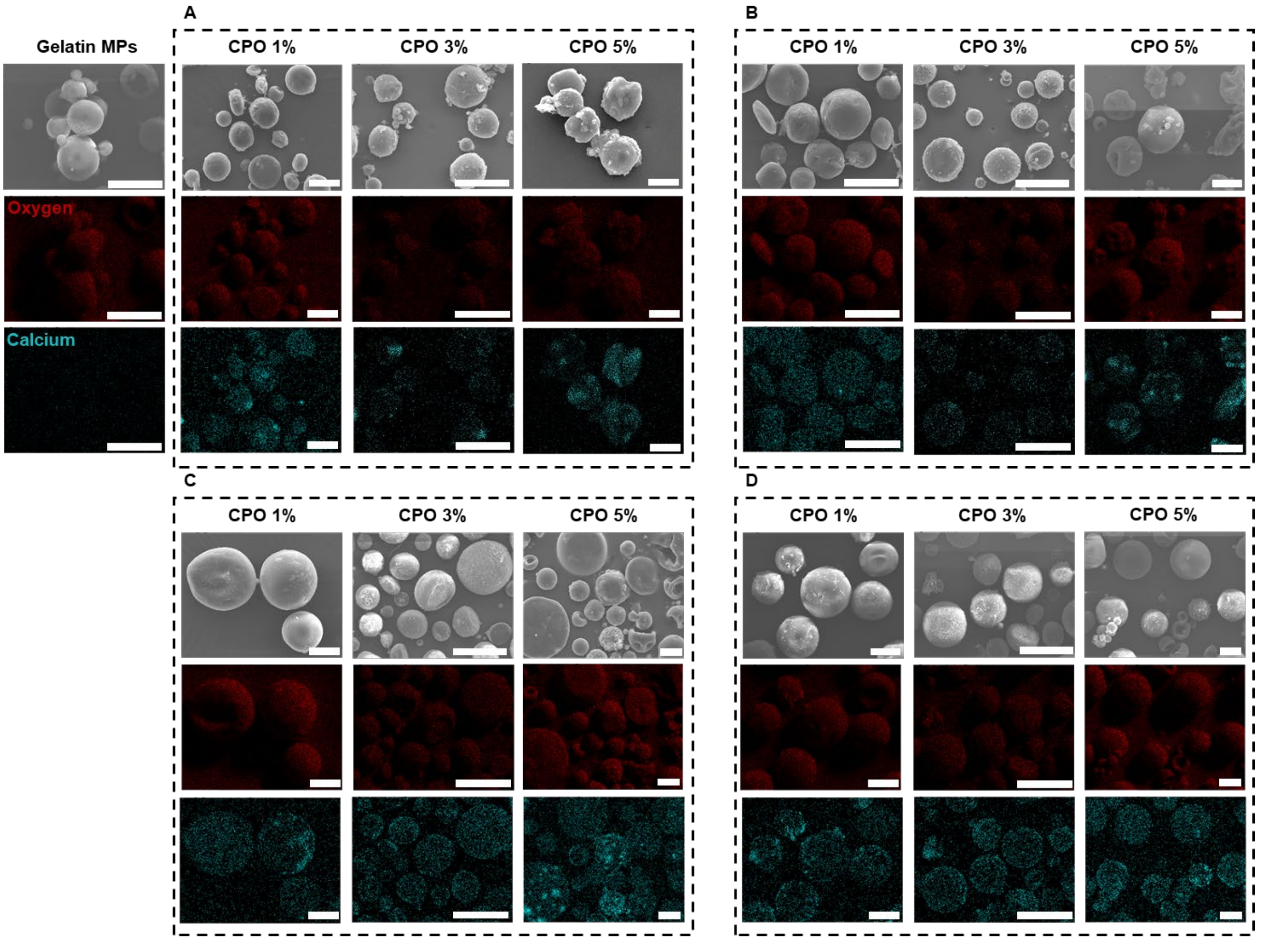


Figure S1. Images of EDS mapping in all formulations of CPO microspheres. Scale bar = 200 μm

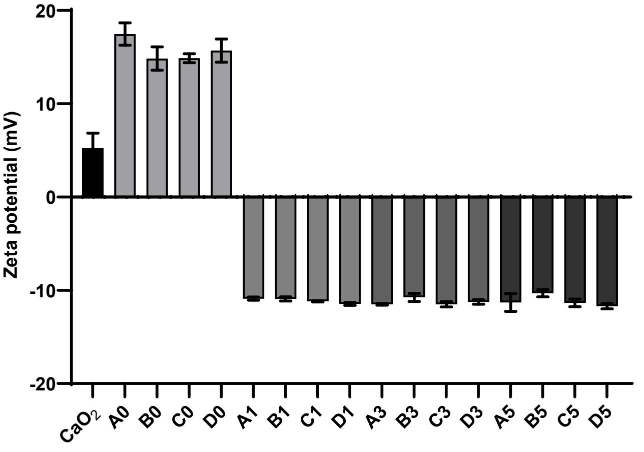


Figure S2. Zeta potential of calcium peroxide (CaO_2) and all formulations of CPO microspheres. Results are presented as means ±SD (n = 4).

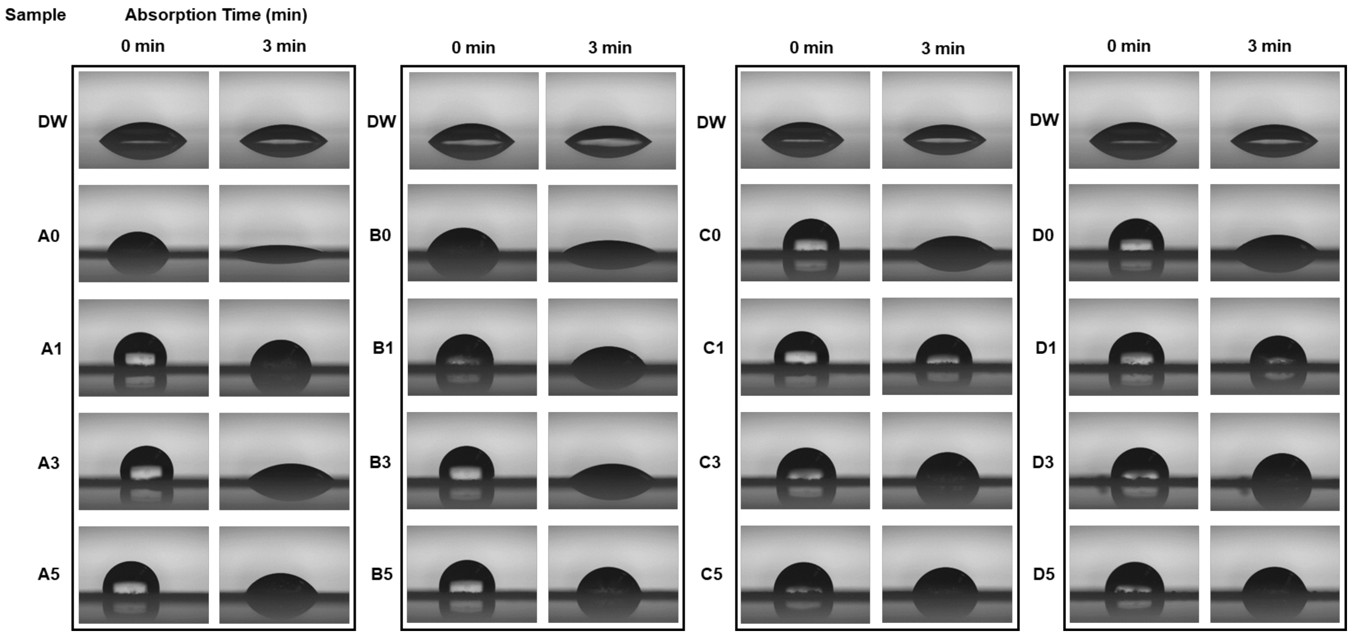


Figure S3. Images of water droplet at 0 min and 3 min on pristine microspheres (A0-D0), and CPO microspheres: CPO1 (A1-D1), CPO3 (A3-D3), and CPO5 (A5-D5).

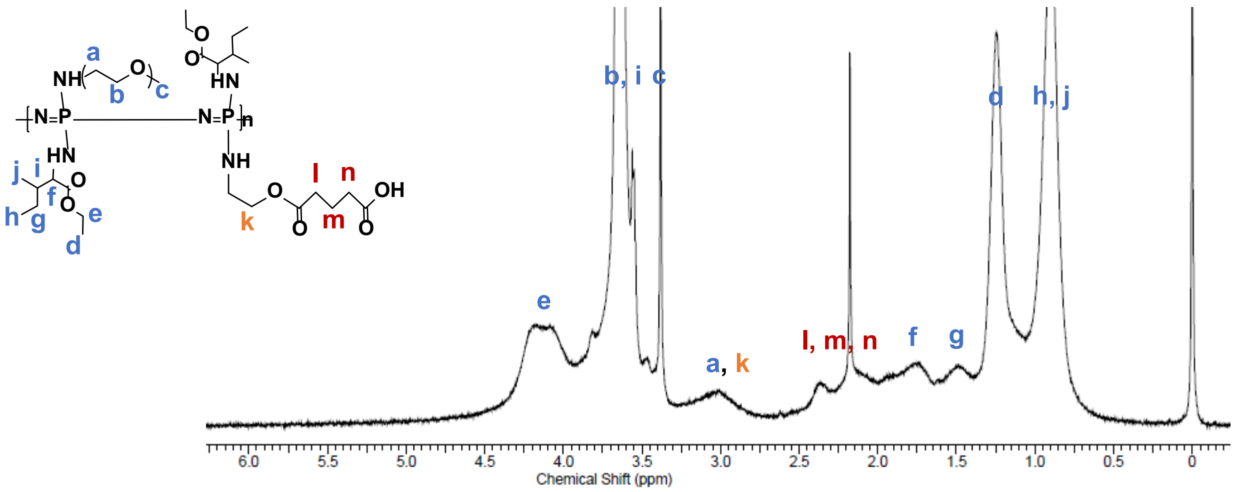
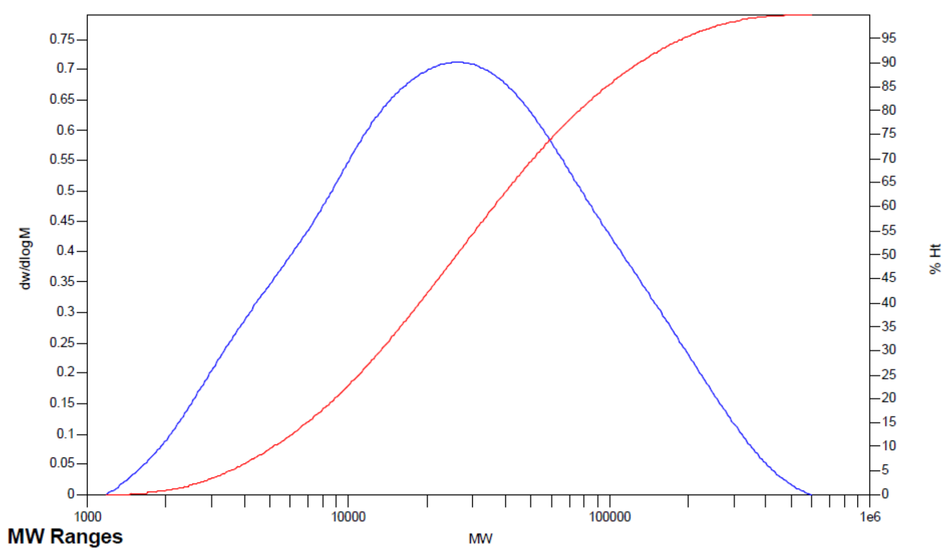


Figure S4. Synthesis of PPZ and its chemical structure. [1]H-NMR of $[NP(IleOet)_{1.23}\ (AMPEG750)_{0.24}\ (AminoEtOH)_{0.36}\ (GA)_{0.17}]_n$



M_p	M_n	M_w	M_z	PDI
26,205	13,152	42,076	137,265	3.86

Figure S5. Gel permeation chromatography of synthesized PPZ. *Mp*: peak molecular weight, *Mn*: number average molecular weight, *Mw*: weight average molecular weight, *Mz*: Z average molecular weight, PDI: polydispersity index (= *Mw / Mn*).

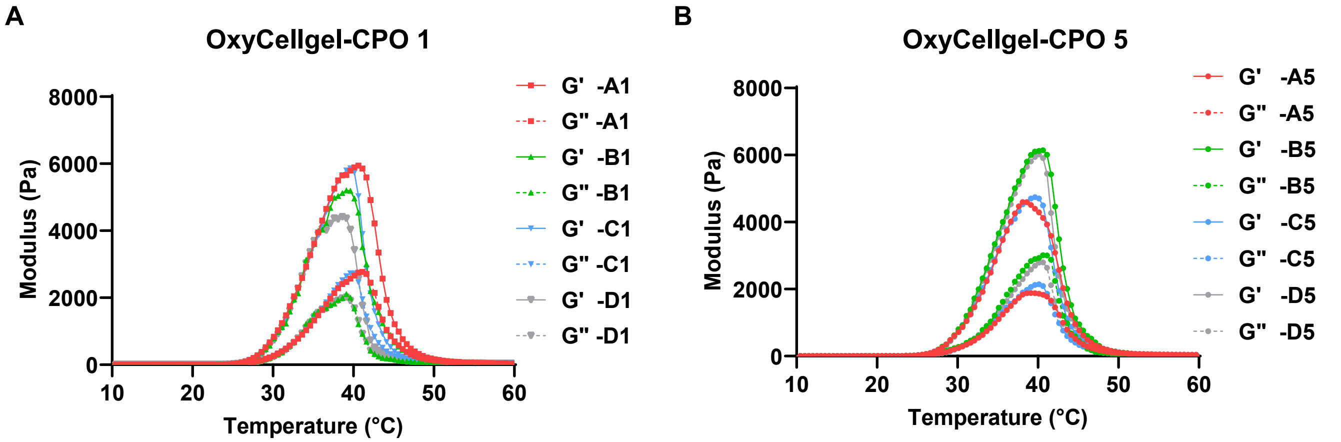


Figure S6. Rheology of CPO microspheres loaded in thermo-responsive PPZ hydrogels. A) Thermo-responsiveness of the storage (G’) and loss moduli (G”) of OxyCellgel-CPO1 microspheres hydrogel, **B)** and OxyCellgel-CPO5 microspheres hydrogel.

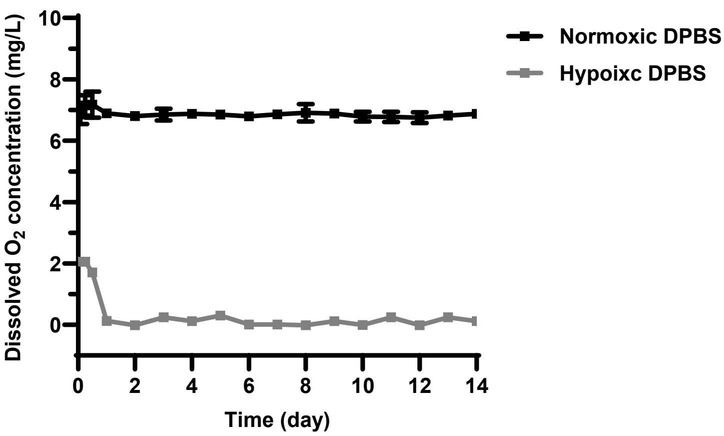


Figure S7. Dissolved oxygen (DO) concentrations of DPBS under normoxic and hypoxic conditions. Baseline DO values were obtained from preliminary measurements conducted under ambient air conditions (normoxia, 21% O_2) and hypoxic conditions (1% O_2). Data are presented as means ±SD (n = 3)

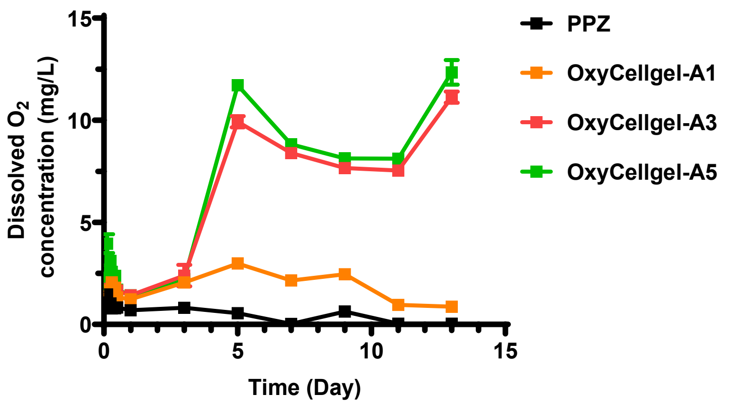


Figure S8. Oxygen release kinetics of different CPO microspheres (A1, A3, and A5) loaded PPZ hydrogels for 14 days. Results are presented as means ±SD (n = 3).

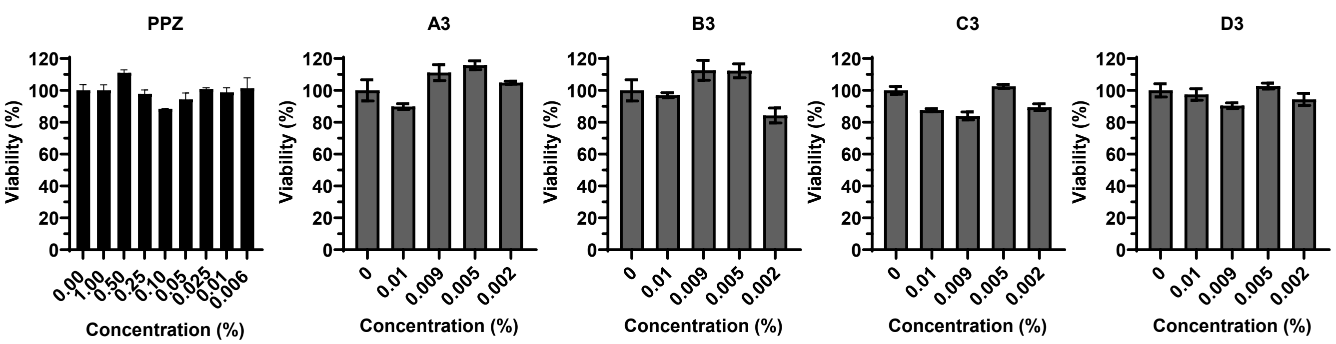


Figure S9. The results of hMSCs viability of quantification of MTT assay. Results are presented as means ±SD (n = 3).

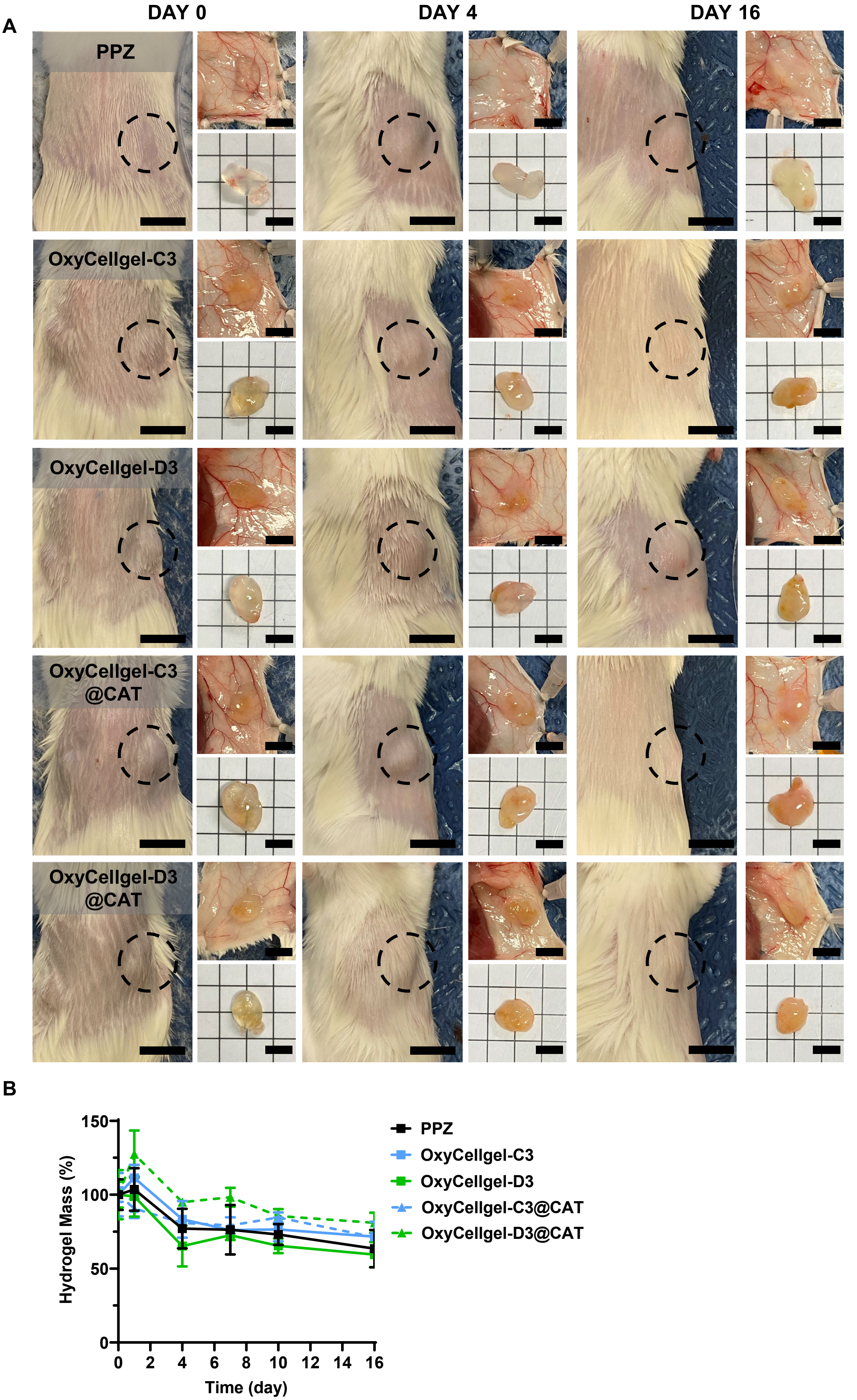


Figure S10. *In vivo* biodegradation study of PPZ and OxyCellgel hydrogels. A) Representative images of hydrogels at predetermined time points. Left: Subcutaneous injection site in the dorsal region. (Scale bar = 1cm). Right: Retrieved hydrogels collected from the injection site. (Scale bar = 5 mm). **B)** Degradation ratio of hydrogels over 16 days in vivo. Results are presented as mean ±SD (n = 3).

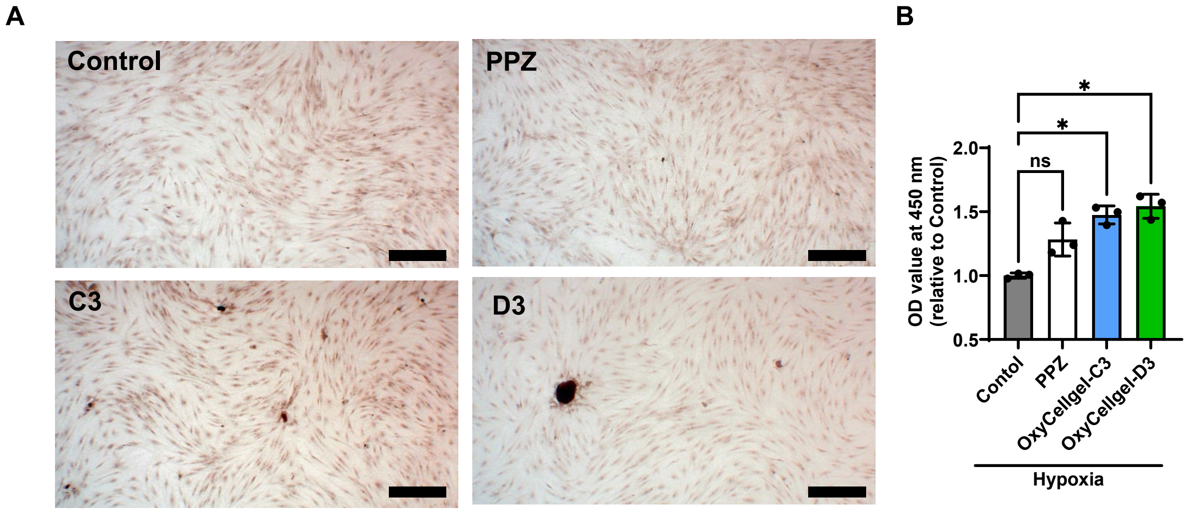


Figure S11. Alizarin Red S staining of hMSCs on day 7 under hypoxia A) Microscopic images of calcium deposition in hMSCs. Scale bar = 400 μm. **B)** Normalized absorbance of calcium deposition stained Alizarin Red S. Results are presented as means ±SD (n = 3).