

Supporting Information

Low-temperature Activable, Carbon Dioxide based, Highly Adhesive and Degradable Oligo-urethane and its Potential Application as Drug Release and Auto-detachable Dressing

Chunjun Zhao^{12#}, Ruoyu Zhang^{1#*}, Shuai Han¹, Xiaowen Yan¹, Keyu Zhao³, Xiaoxia Zhu^{3*}, Lijing Han^{1*}

1 Zhejiang International Scientific and Technological Cooperative Base of Biomedical Materials and Technology, Zhejiang Engineering Research Center for Biomedical Materials, Cixi Institute of Biomedical Engineering, Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, Ningbo 315300, China

2 Nano Science and Technology Institute, University of Science and Technology of China, Hefei, Anhui 230023, People's Republic of China

3 The Affiliated Hospital of Medical School, Ningbo University, Ningbo 315020, People's Republic of China

Corresponding authors:

Ruoyu Zhang (zhangruoyu@nimte.ac.cn)

Xiaoxia Zhu (15944427@qq.com)

Lijing Han (lijinghan@nimte.ac.cn)

Table S1. Compositions and characterization of the synthesized OUs

Batch No.	PPCG (g)	Chain extender (g)	IPDI (g)	Catalyst (g)	$M_n/10^3$ (g/mol)	$M_w/10^4$ (g/mol)	PDI
OU-1	16.00	0.50	2.80	0.25	6.75	1.28	1.89
OU-2	16.00	1.00	3.73	0.25	5.70	1.01	1.77
OU-3	16.00	1.50	4.67	0.25	8.04	1.23	1.23
OU-4	16.00	2.00	5.60	0.25	5.76	0.91	1.60

Note: 1) $M_n=2000$ g/mol (PPCG).

2) Catalyst: Dibutyltin dilaurate.

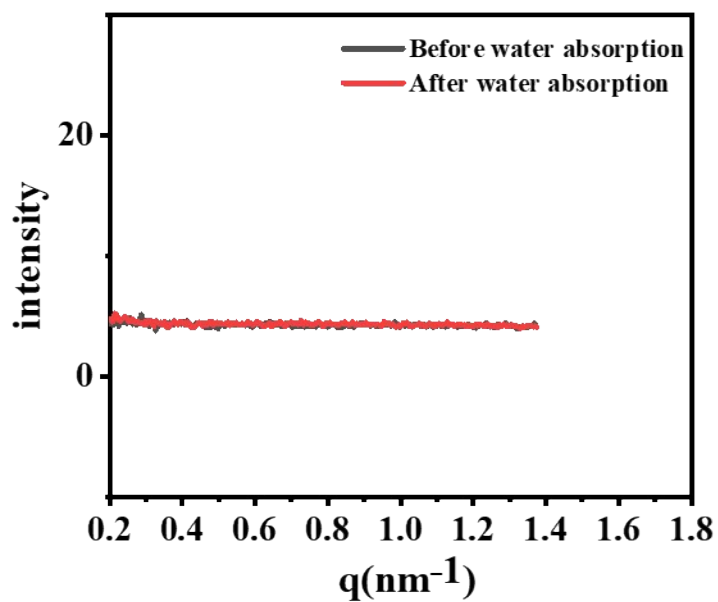


Figure S1. 1D-SAXS curves of the OU-3 films before and after water absorption.

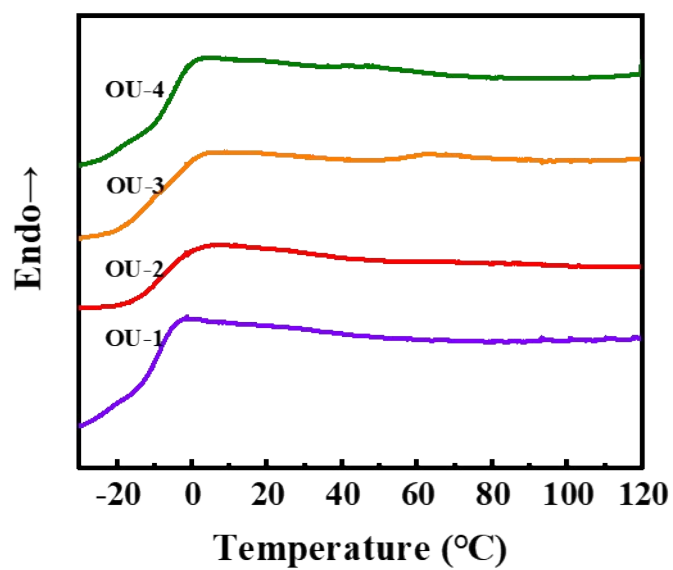


Figure S2. DSC curves of OUs (1~4) with various chain extender contents.

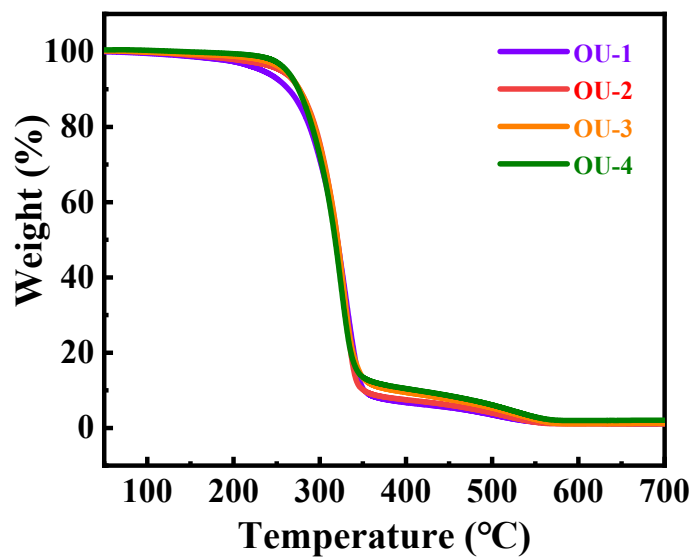


Figure S3. TGA curves of OUs (1~4) with various chain extender contents.

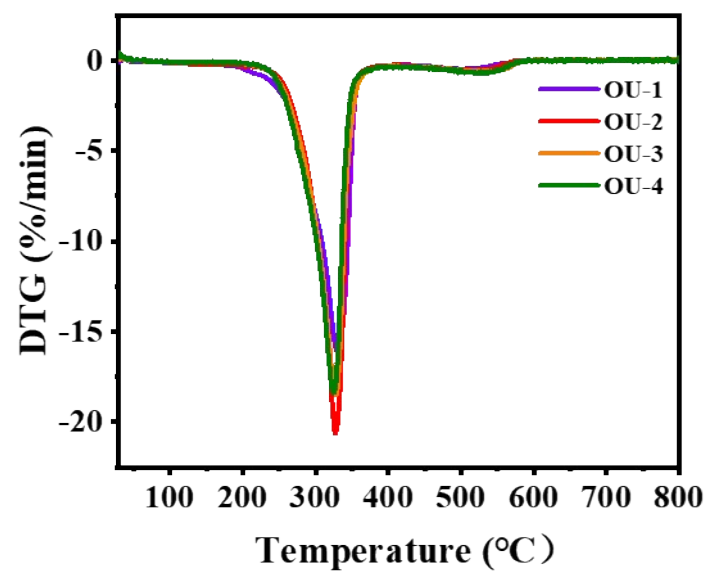


Figure S4. DTG curves of OUs (1~4) with various chain extender contents.

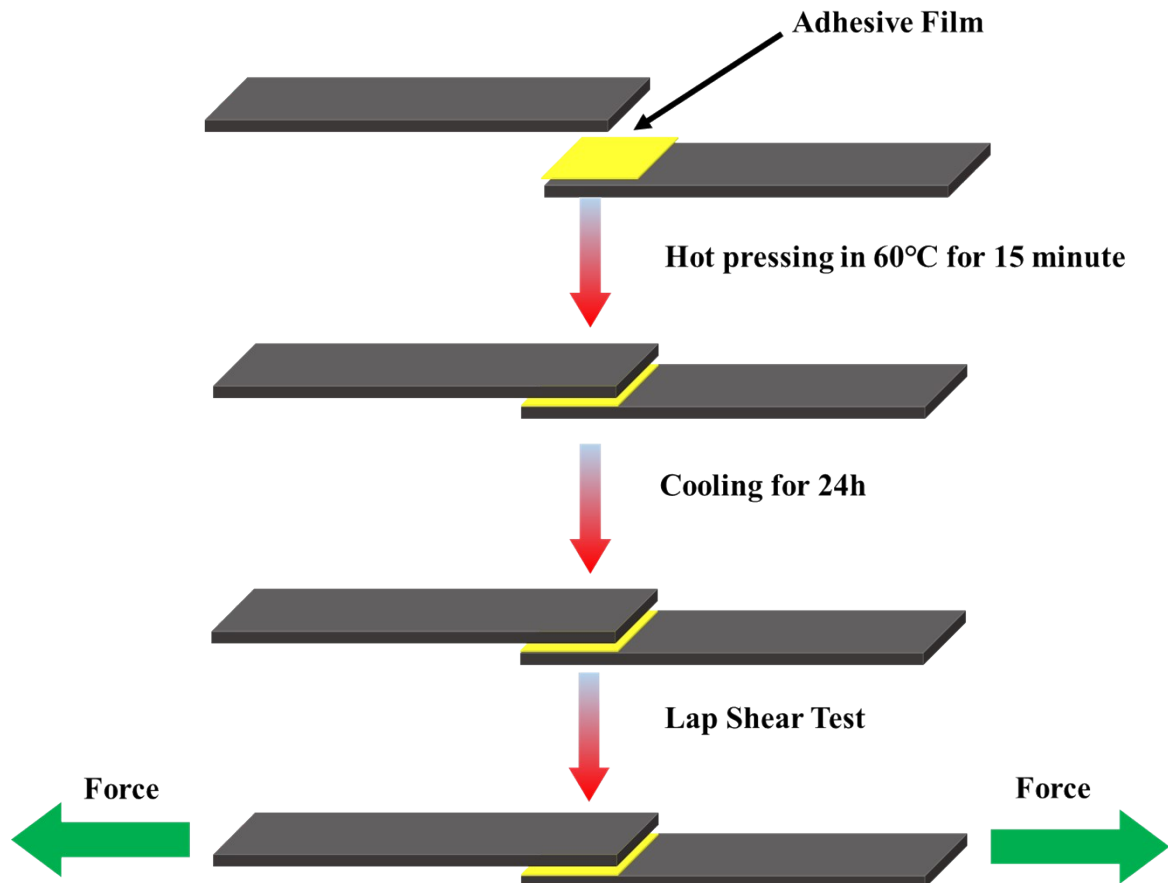
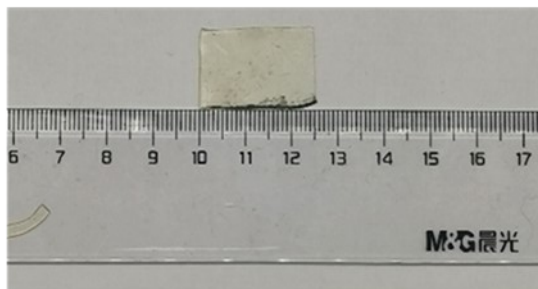


Figure S5. Schematic diagram of the adhesion and lap shear experiment procedure. The hot pressing is carried out at 60 °C.

(a)



(b)

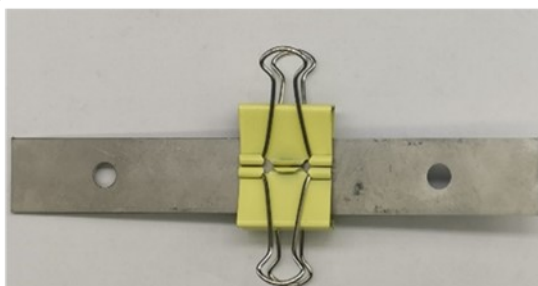


Figure S6. (a) A film of OU-3 for adhesion experiment. (b) Two pieces of stainless steel and OU-3 held together by two paper clips.

Table S2. Mechanical properties of OU samples

Name	Tensile strength (MPa)	Elongation (%)	Young's Modulus (MPa)	Fracture Toughness (MJ/m ³)
OU-1	0.27±0.06	1079.3±28.2	0.65±0.05	2.05±0.53
OU-2	0.36±0.10	980.8±19.2	1.40±0.03	2.41±0.12
OU-3	2.45±0.06	317.4±19.7	9.70±1.52	6.43±0.68
OU-4	2.23±0.22	270.7±18.7	6.71±1.17	5.43±0.09

Table S3. Summary of the assignment of the deconvoluted subpeaks in the FTIR C=O absorption bands for the OU-1, OU-2, OU-3 and OU-4.

Assignment		Wavenumber (cm ⁻¹)				Area (%)			
		OU-1	OU-2	OU-3	OU-4	OU-1	OU-2	OU-3	OU-4
v(C=O) urethane amide	Free	I (1747)	I (1742)	I (1743)	I (1742)	53.5%	55.4%	52.0%	49.26%
	H-bonded (Ordered)	II (1719)	II (1712)	II (1713)	II (1715)	12.1%	18.9%	12.5%	14.81%
v(C=O) urea amide	Free	III(1696)	III(1692)	III(1697)	III(1692)	12.0%	7.1%	2.9%	11.85%
	H-bonded (Disordered)	IV(1661)	IV(1672)	IV(1677)	IV(1661)	14.5%	8.6%	11.25%	16.30%
	H-bonded (Ordered)	V (1642)	V (1654)	V (1658)	V (1642)	4%	7.2%	5.83%	6.10%
v(C=O) amide	H-bonded (Ordered)	VI(1611)	VI(1642)	VI(1646)	VII(1608)	3.1%	2.6%	15.41%	1.50%
Total degree of H-bonded						34.4%	37.4%	45.0%	38.8%

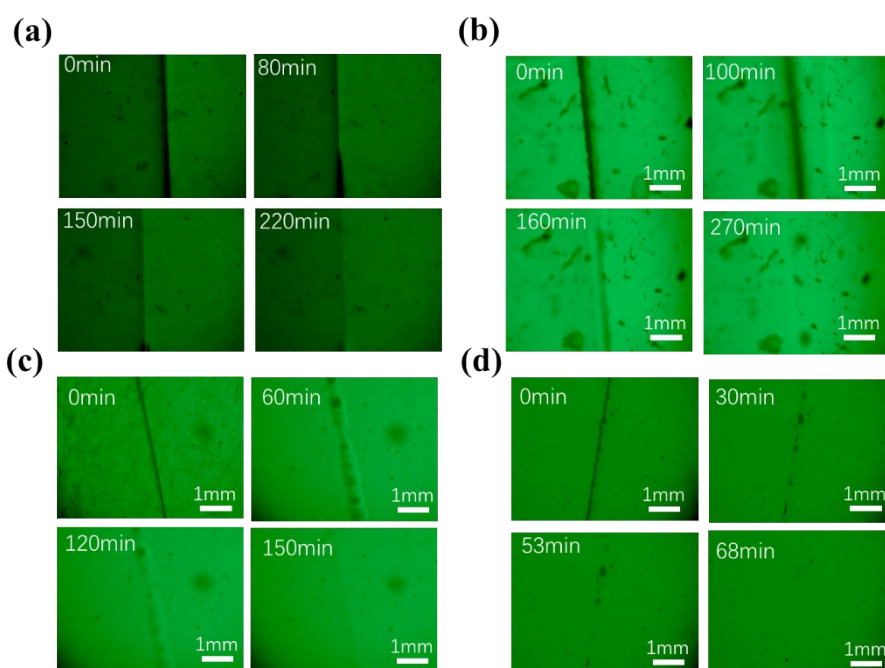


Figure S7. The self-healing processes of OU-3 at different temperatures. (a) 40 °C (b) 50 °C (c) 60 °C (d) 70 °C.

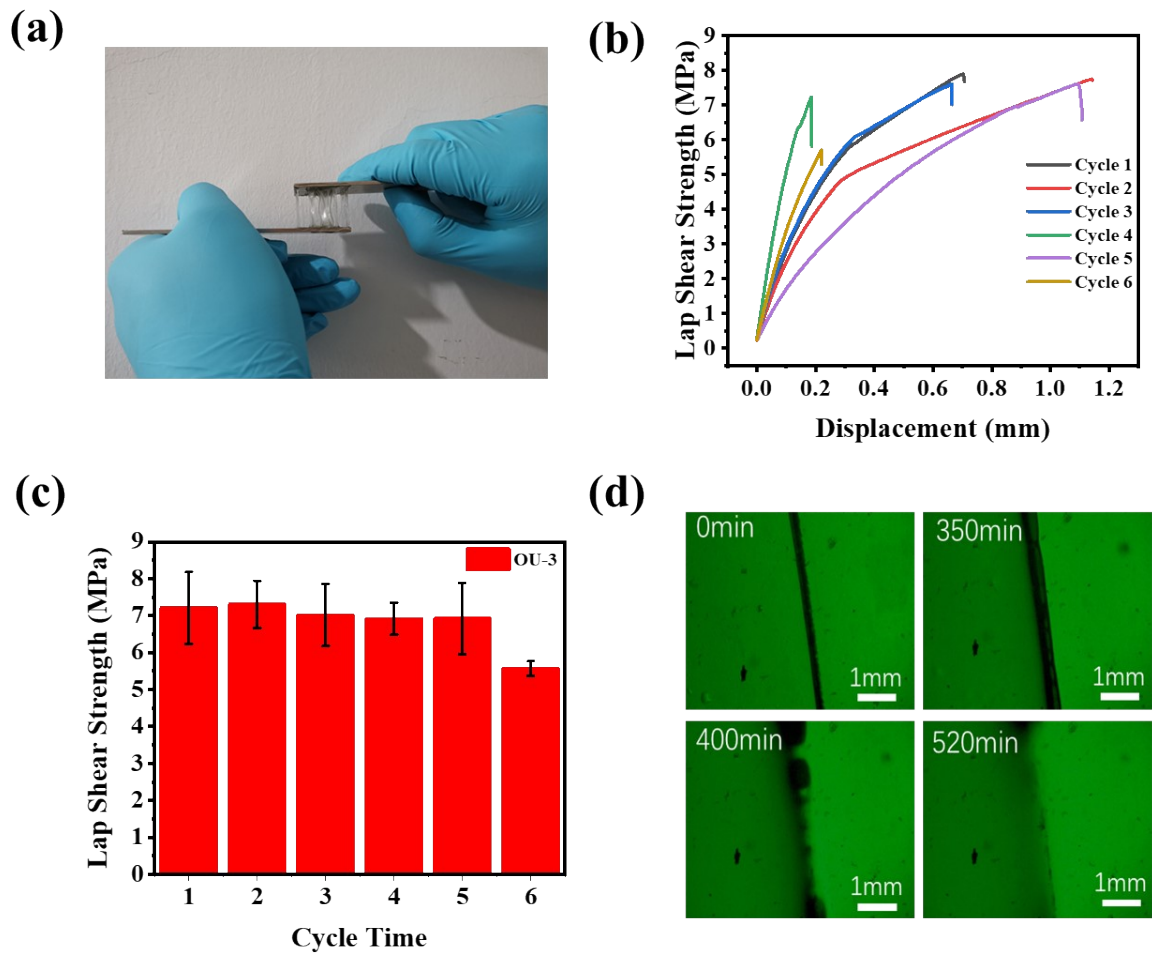


Figure S8. (a) Debonding of the two stainless steel plates at an elevated temperature. (b) Lap shear strength-displacement curves. (c) Lap shear strength of OU-3 in recycling test with stainless steel as matrix. (d) Optical microscopic images of a self-healing process of a cut-off OU-3 film at room temperature.

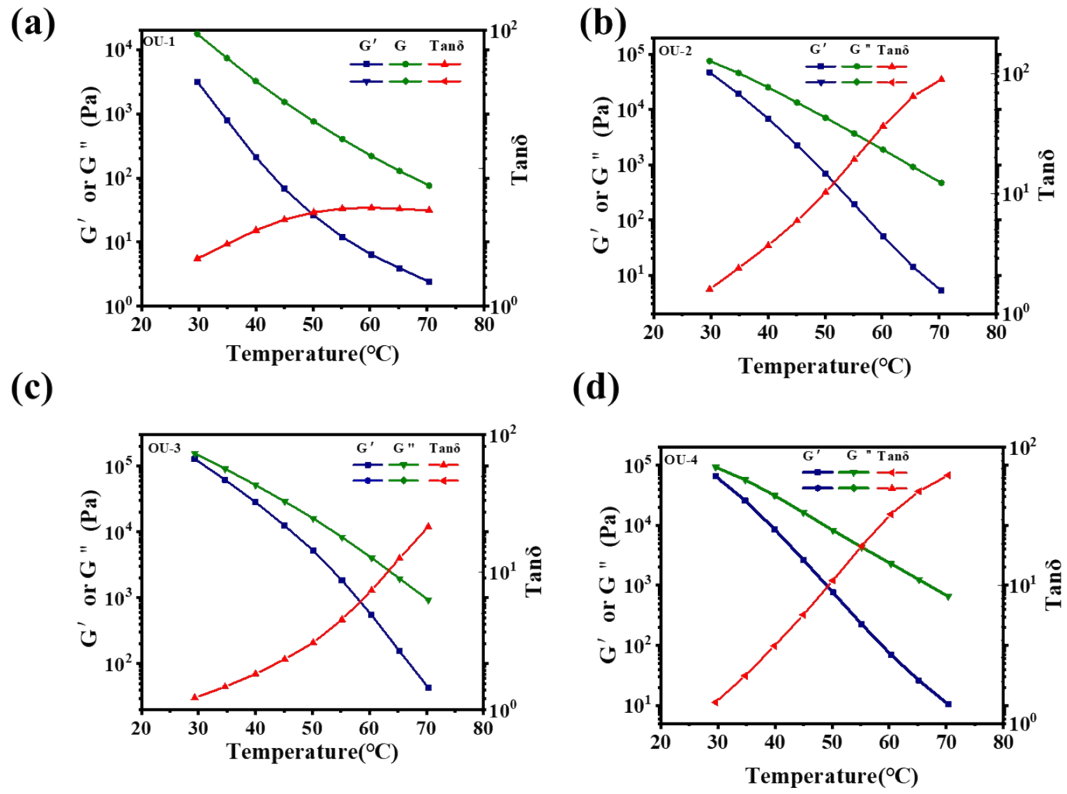


Figure S9. The rheological temperature sweep experiment from 70 °C to 30 °C of OUs 1-4.

Table S4. Absorbance of aquatic gentamicin solutions with different concentrations

Sample	Concentration (mg/ml)	Absorbance (a.u)
1	0.005	0.03157
2	0.010	0.06236
3	0.015	0.09722
4	0.020	0.14012

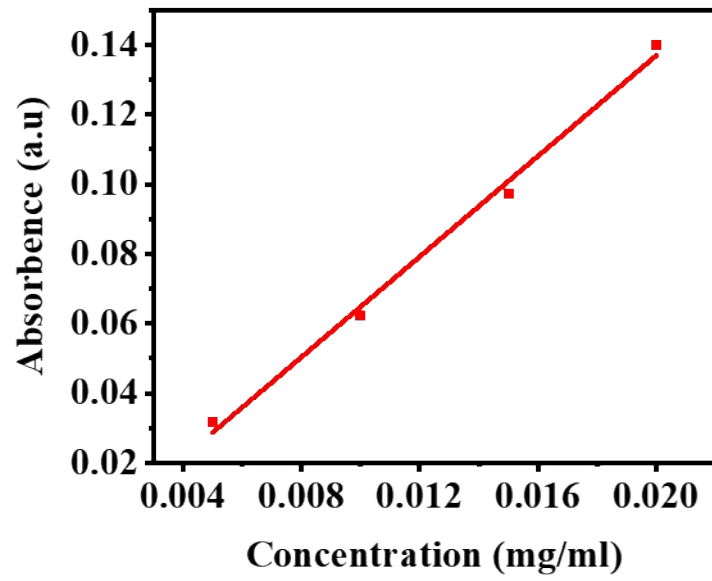


Figure S10. The linear absorbance line of gentamicin solutions.

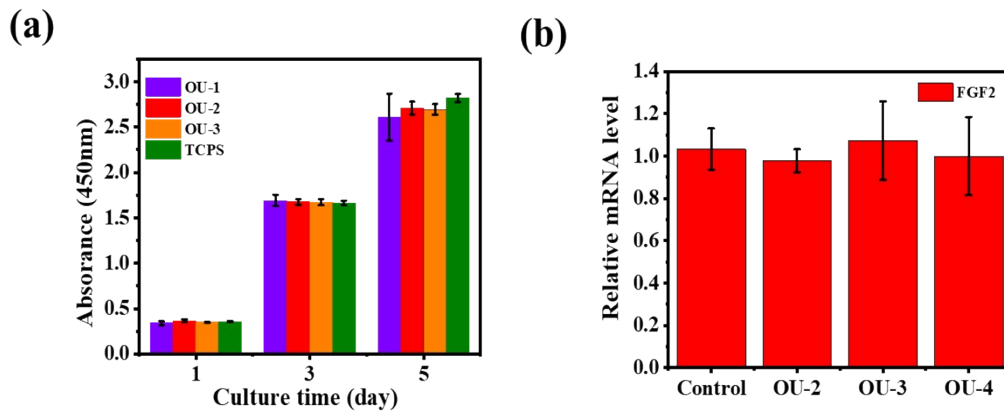


Figure S11. (a) The CCK-8 test of the OU films; (b) The FGF2 level of the OU films.