Preparation of Conductive Hydrogel and Its Effect on the Proliferation of Neural Stem Cells

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Introduction

Conductive hydrogels open up new possibilities for neural stem cells (NSCs) transplantation for the treatment of neurodegenerative diseases (NDs) and traumatic brain injury (TBI).

Method

In this study, a novel carboxymethyl chitosan/gelatin/poly(3,4-ethylenedioxythiophene) (CMCS/Gel-PEDOT) hydrogel with different contents of EDOT monomer was prepared by lyophilization and in-situ polymerization.

Table 1. Conductivity of hydrogels (27 ± 2℃, dry state)

Hydrogels	CMCS/Gel	CMCS/Gel-0.1 EDOT	CMCS/Gel-0.15 EDOT	CMCS/Gel-0.2 EDOT
Conductivity (S/cm)	3.1×10^{-6}	8.7×10^{-5}	5.5×10^{-4}	1.5×10^{-3}

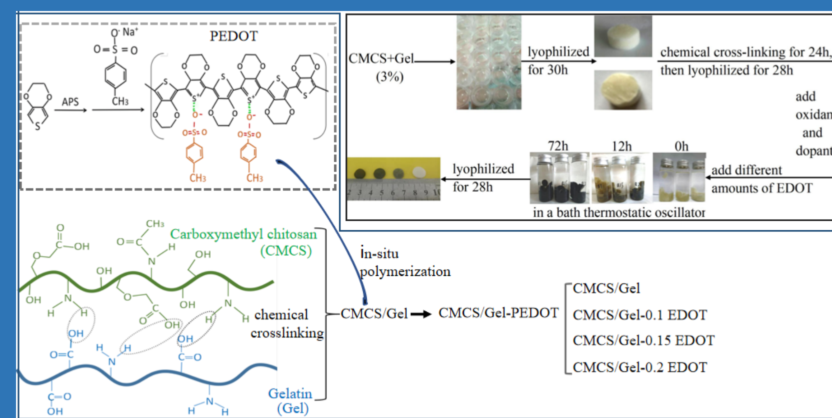

Fig. 1 Schematic diagram of the preparation of hydrogels

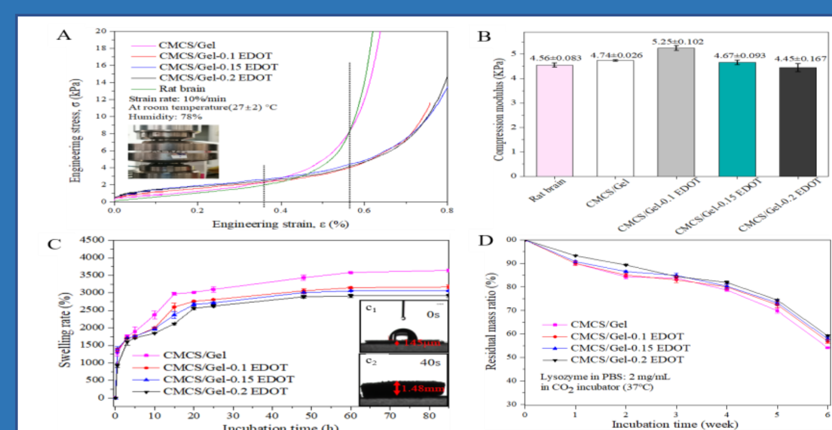

Fig. 2 (A) Stress-strain curves and (B) compressive moduli of hydrogels. (C) Swelling curves of hydrogels in PBS (pH = 7.45) and (c_1, c_2) swelling images of compressed hydrogels. (D) Degradation curves of hydrogels in lysozyme solution.

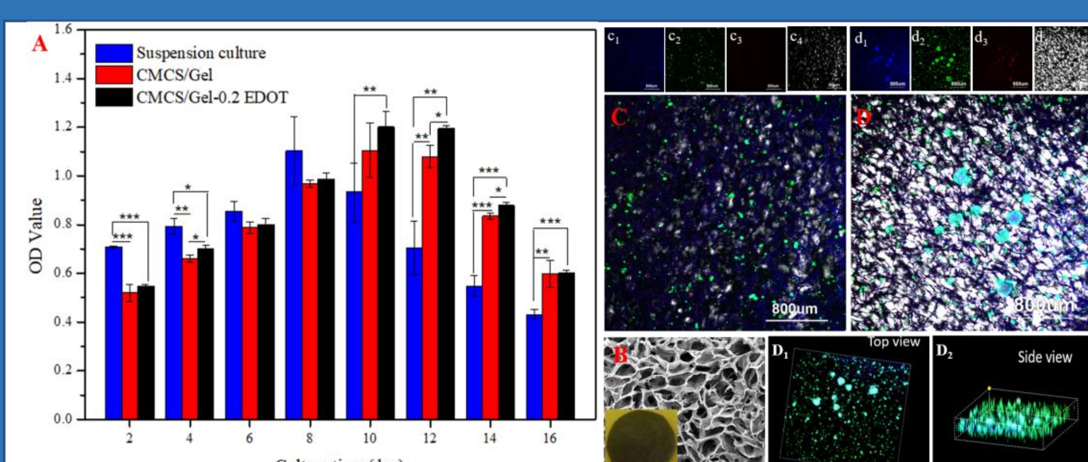

Fig. 3 (A) Viability of NSCs in CMCS/Gel hydrogel and conductive CMCS/Gel-0.2 EDOT hydrogel. (B) Morphology of the hydrogel. (C, D) The state of NSCs on the 3rd, 10th day after being seeded into the hydrogel, respectively.

Conclusion

The mechanical properties of the prepared hydrogels were similar to those of brain tissue, with electrical conductivity up to 1.5×10^{-3} S/cm, swelling rate up to (2919 ± 48) %, and adequate in vitro biodegradability within 6 weeks. Furthermore, the conductive hydrogel had good cytocompatibility and was conducive to cell growth and proliferation.

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References

[1]R. Cacabelos, Int. J. Mol. Sci. 21 (2020) 3059.
[2]L. Zhao, J. W. Liu, H. Y. Shi, and Y. M. Ma, World J. Stem Cells 13 (2021) 1278-1292.
[3]M. Cui, H. Ge, H. Zhao, Y. Zou, Y. Chen, and H. Feng, Stem Cells Int. 2017 (2017) 9898439.
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