Thermogels as an injectable 3D scaffold

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Abstract

Statement of the Problem: 3D scaffolds with in situ forming properties have been extensively investigated for injectable tissue engineering applications. Chemical reactions or physical association triggered by change in external stimuli lead to the formation of the cell-incorporating hydrogel. However, to achieve the sustained delivery of growth factors, live cell retention, and targeted differentiation into the cells are required in the in situ formed gel, which are based on the well-defined chemical and physical properties of a polymer.

Methodology & Theoretical Orientation: We have been developing thermogels which undergo solution-to-gel transition as temperature increases. Mild and cyto-compatible procedure for gel formation as well as capability to maintain a neutral pH during the degradation, polypeptide-based thermogels are proved to be an excellent platform for such purpose. As an injectable scaffold of stem cells, the physicochemical properties the polypeptide thermogels and composite systems of the thermogels have been characterized. In addition, cell viability, differentiation of stem cells into target cells were monitored by using biomarker expressions and biofunctions of the differentiated cells.

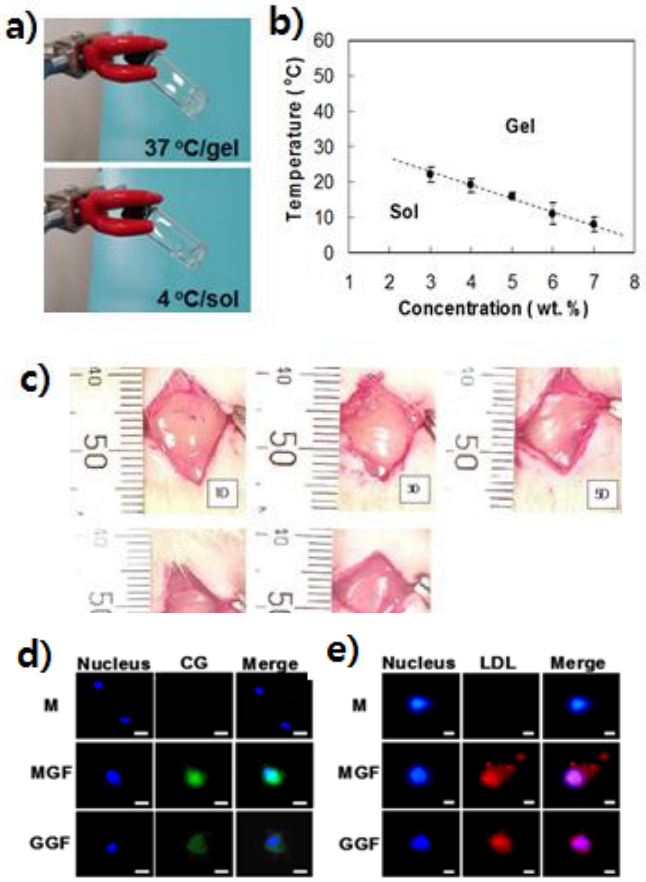
Conclusion & Significance: Polypeptide-based thermogels are very promising scaffolds for injectable tissue engineering applications and stem cell therapy to replace damaged/disease tissues in the future.

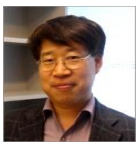
Recent Publications

1. Hong JH, Lee HJ, Jeong B (2017) ACS Appl. Mater. Interfaces 9, 11568-11576.
2. Moon HJ, Patel M, Chung H, Jeong B (2016). Adv. Healthcare Mater., 5, 353-363.
3. Park J, Kim IY, Patel M, Moon HJ, Hwang SJ, Jeong B (2015). Adv. Funct. Mater. 25, 2573-2582.
4. Ko DY, Shinde UP, Yeon B, Jeong B (2013). Prog. Polym. Sci. 38, 672-701.
5. Park MH, Choi BK, Jeong B (2012). Adv. Funct. Mater. 22, 5118-5125.

Image

Figure. a) Photo images of sol and gel states of a polypeptide thermogel. b) Phase diagram of sol-to-gel transition of the polypeptide aqueous solutions. c) in-situ gel formation upon subcutaneous injection of polypeptide aqueous solutions into rats. Hepatogenic differentiations of stem cells in the polypeptide thermogel. Uptakes of cardiogreen (CG) and low density lipoprotein (LDL) are shown in d and e) for biofunction assay of the differentiated cells from the stem cells.





Biography

Byeongmoon Jeong received his B.S. (1987) in the Department of Chemistry from Seoul National University, M.S (1989) from KAIST, and his Ph.D. (1999) in the Department of Pharmaceutics and Pharmaceutical Chemistry at the University of Utah. He worked at the Pacific Northwest National Laboratory, USA as a senior research scientist before joining Ewha Womans University in 2002. He pioneered biodegradable thermogels and has authored 120 international peer-reviewed papers and patents on stimuli-sensitive polymers; His publications have been cited 9,000 times during the last two decades. In 2009, he became Director of the National Research Laboratory on biodegradable thermogels. He received an Achievement Award in the Polymer Division of Korean Chemical Society (2010). He was selected as Ewha Fellow at Ewha Womans University in 2014. His research concentrates on stimuli-sensitive hydrogels and their applications for drug delivery and tissue engineering.

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