Mechano-responsive hydrogel developed for wound healing

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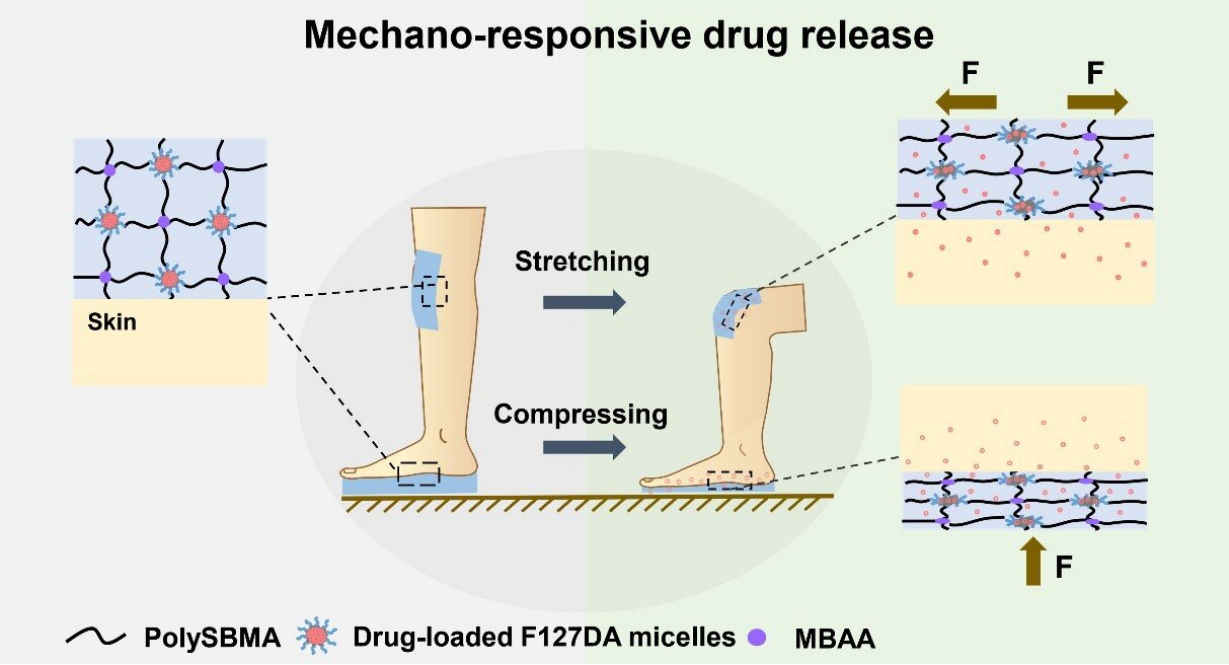

Schematic illustration of mechano-responsive hydrogel for wound healing. Credit: NIMTE

Dr. Wang Rong's team from the Cixi Institute of Biomedical Engineering, Ningbo Institute of Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences, in cooperation with the researchers from Sun Yat-sen University and Nanchang University, has developed a mechano-responsive antibacterial hydrogel with controllable

drug release behavior for wound healing application. The study was published in *ACS Applied Materials & Interfaces*.

In recent decades, hydrogels for wound healing have attracted tremendous attention around the globe. However, acute cutaneous wounds on moving body parts usually suffered from various mechanical forces, such as stretching forces and compressive forces under dynamic circumstances, thus the healing process was easily interfered.

Traditional hydrogels have limited efficacy owing to their poor mechanical properties, skin adhesiveness and drug delivery efficiency. To address this problem, the researchers in this study designed a tough, antibacterial, drug-loaded mechano-responsive zwitterionic hydrogel.

Diacrylate Pluronic F127 (F127DA) micelles were used as macro-cross-linkers and drug carriers. The developed micelle-cross-linked hydrogel showed superior mechanical properties, with the ultimate tensile strength and tensile strain of up to 112 kPa and 1420%, respectively, and compressive stress of up to 1.41 MPa.

Additionally, poly(sulfobetaine methacrylate) (polySBMA) endowed the hydrogel with excellent tissue adhesiveness (?6 kPa) and an antifouling property. When the micelle-crosslinked hydrogel was subjected to mechanical forces, the weak hydrophobic association in the micelles was destroyed, the combination between bioactive drug and the micelle core was destabilized, resulting in responsive drug release behavior. Results showed that the drug release from the hydrogel could be precisely controlled by mechanical strength and cycles, which endowing the hydrogel a broad-spectrum antibacterial property against both Gram-positive and Gram-negative bacteria.

In addition, zwitterionic polySBMA possesses high hydration ability to

form a stable repulsive boundary layer under aqueous conditions, thus the prepared hydrogel effectively inhibited protein adsorption and bacteria adhesion. The hydrogel showed good biocompatibility to mammal cells and efficiently promoted wound healing in a full-thickness skin defect mice model.

This tough, mechano-responsive, antibacterial and biocompatible hydrogel holds great promise for wound treatment in a complex dynamic environment.

More information: Kun Fang et al. Mechano-Responsive, Tough, and Antibacterial Zwitterionic Hydrogels with Controllable Drug Release for Wound Healing Applications, *ACS Applied Materials & Interfaces* (2020). DOI: 10.1021/acsami.0c13009

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