

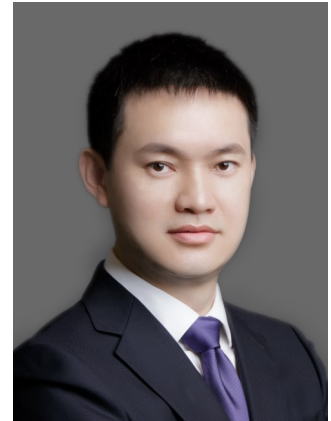


Topic of the Speech:

Supercritical Fluid Technology-based Decellularized Extracellular Matrix for Biomedical Application

Professor Aizheng Chen

Huaqiao University
China



Professor Aizheng Chen received his Ph.D. degree in Biomedical Engineering from Sichuan University in 2007. After postdoctoral research at The Hong Kong Polytechnic University for two years, he joined Huaqiao University, where he is now a professor and vice dean of College of Chemical Engineering, and director of Institute of Biomaterials and Tissue Engineering. He also serves as a committee member of Chinese Society for Biomaterials, and the secretary-general of Chinese Society for Biomaterial-Composite Materials Branch. He was a visiting research professor for a year in Prof. Ali Khademhosseini Lab at Harvard medical school. He has been granted 9 National projects, and has published more than 150 peer-reviewed publications.

His research interests are the application of biomaterials for drug delivery systems using supercritical fluid technology, tissue engineering and regenerative medicine. He was listed in 2020 National Hundred, Thousand and Ten Thousand Talent Project and awarded with an honorary title “Young and mid-aged expert with outstanding contribution”.

Supercritical Fluid Technology-based Decellularized Extracellular Matrix for Biomedical Applications

Ai-Zheng Chen^{*}, Ranjith Kumar Kankala, Shi-Bin Wang

Institute of Biomaterials and Tissue Engineering, Huaqiao University, Xiamen, 361021, China

^{*}Presenter's email: azchen@hqu.edu.cn

ABSTRACT (NO MORE THAN 500 WORDS:)

Recently, decellularized extracellular matrix (dECM) has garnered enormous interest in the fields of tissue regeneration due to its exceptional conservation of biological cues for tissue repair. However, the traditional decellularization methods, including chemical and enzymatic approaches, still face challenges, such as residual chemical reagents, damage to active components, and high costs, limiting the broad applicability of dECM. Therefore, developing a mild and efficient decellularization method is crucial for expanding the applications of dECM materials and developing new products. Herein, we propose the utilization of supercritical fluid (SCF)-based technology to prepare dECM and optimize various process parameters for the construction of drug carriers and tissue regeneration applications. Firstly, we investigate the impact of temperature, pressure, and processing time on the decellularization of porcine skin to determine the optimal process conditions. Under these conditions, immunogenic components can be effectively removed, and the biological components of dECM, such as total proteins, collagen, and glycosaminoglycans, can be maximally preserved. Further, we utilize the supercritical antisolvent (SAS) process to prepare uniformly distributed dECM nanoparticles loaded with the antibacterial drug tobramycin, aimed at promoting the repair of infected skin wounds, which is the first related work on dECM nanoparticles. Next, we use electrostatic spinning technology to make the dECM into a fiber membrane and uniformly loaded with stem cell secretome (Sec) to construct a composite artificial skin. This composite artificial skin avoids the current issues of insufficient nutrient supply and slow cell proliferation in the wound areas of artificial skins, achieves effective loading of Sec, and ultimately promotes skin wound repair and collagen regeneration effectively. In addition, we further enzymatically dissociate the dECM prepared by SCF technology to obtain a water-soluble dECM pre-gel. An injectable microsphere-hydrogel composite system is constructed by combining the pre-gel with PLLA microspheres containing Sec. This system proves to be effective for long-term soft tissue augmentation and promoting collagen deposition and tissue regeneration, offering promising new products and methods for cosmetic and reconstructive surgery with excellent clinical application prospects. In summary, the use of green and efficient SCF technology has significant economic implications in preparing dECM and developing various biomaterials, which offer promising alternatives for tissue repair and regeneration applications.