## INNOVATIVE MULTILAYERED PATCHES FOR TREATING ACUTE AND CHRONIC MYOCARDIAL INFARCTION: DEVELOPMENT AND CHARACTERIZATION

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This research aims to advance cardiac patch technology for the treatment of both acute and chronic myocardial infarction (MI). We have engineered an innovative multilayered system that incorporates biodegradable polymers along with conductive and bioactive molecules to enhance cardiac repair and mitigate fibrosis. The multilayered patch consists of two external microstructured membranes made of PLGA/gelatin and a conductive molecule. Sandwiched between these membranes, there is a hydrogel matrix containing gelatin and the conductive molecule, with a third microstructured membrane of PCL/gelatin embedded within. Bioactive molecules with cardioprotective properties, when present, were integrated into both the membranes and the hydrogel. We compared the performance of a bi-layered patch (comprising two external membranes and the hydrogel) with that of different tri-layered patches (including an additional PCL/gelatin membrane within the hydrogel). To analyze the structural and functional properties of the patches, we employed various characterization techniques such as SEM, DMA, DSC, TGA, FT-IR Chemical Imaging, and HPLC. The results confirmed the successful integration of all components in the multilayered patches. The tri-layered patch demonstrated suitable mechanical stability and satisfactory thermal properties compared to the bi-layered patch. Chemical imaging verified the successful incorporation of the bioactive molecules, with a uniform distribution of the layers at their interfaces. Additionally, the tri-layered patch showed effective therapeutic agent release and a slower degradation rate. The development of these multilayered patches, particularly the tri-layered design, presents significant potential for delivering cardioprotective and anti-fibrotic therapies. Future work will involve further in vitro and in vivo studies, with the ultimate goal of achieving clinical application for these advanced cardiac patches.

Keywords: Multilayered Cardiac Patches; Myocardial Infarction Treatment; Biodegradable Polymer; Cardioprotective Bioactive Molecules; Conductive Hydrogel

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