Fabrication of Doxorubicin Loaded Microneedle Patch for Cancer Therapeutics

Jahnavi Manapuram
School of Biosciences and Technology, Vellore Institute of Technology (VIT), Vellore, India
Dr. Arunkumar Pitchaimani
Centre for Biomaterials, Cellular and Molecular Theranostics, Vellore Institute of Technology (VIT), Vellore, India

Abstract

This study focusses on the fabrication of doxorubicin loaded microneedle patch for localized cancer therapy. Microneedles with a height of approximately 300µm and base 100µm were fabricated using the solvent evaporation technique at varying doxorubicin and PLGA ratios of 1:50, 1:25, 1:20, 1:15, 1:10 to find the optimal concentration of drug to be loaded to the microneedle structure. The fabricated microneedles were characterized by stereomicroscopy, scanning electron microscopy and confocal laser scanning microscopy to analyze the surface features, microneedle structural dimensions and drug distribution. In vitro studies were performed to determine the loading efficiency of the concentration ratios analyzed by the UV- visible spectrophotometer and depicted a gradual increase with higher doxorubicin: polymer ratios. The therapeutic potential of the system is to be tested for the treatment of breast cancer using 4T1 mouse breast cancer cell lines. The findings demonstrate that doxorubicin loaded microneedles are minimally invasive and allow for sustained release of the drug at the tumor site and are characterized by reduced systemic toxicity as when compared to free drug administered intravenously.

Index Terms

Drug Loaded Microneedles, Doxorubicin, Controlled Drug Release, Breast Cancer Therapy, Biocompatibility, Cytotoxicity