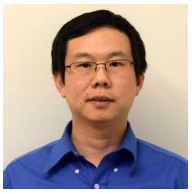
Acta Chimica and Pharmaceutica Indica
ISSN: 2277-288X

Laser facilitates week-long sustained transdermal drug delivery at high doses



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Abstract

Traditional patches are most successful in transdermal delivery of low-dose hydrophobic drugs. Week-long transdermal delivery of high-dose hydrophilic drugs remains a big challenge. We recently developed a laser-based powder delivery platform to allow high-dose week-long sustained delivery of hydrophilic drugs across the skin. This platform is based on laser treatment to generate skin microchannels (MCs) followed by topical application of powder drug- coated reservoir patches. Water evaporated from skin MCs gradually dissolve topical drug powder to elicit week-long sustained drug delivery in murine models. Using sulforhodamine b, zidovudine, and bovine serum albumin as model hydrophilic drugs, we found tapped coating could coat 10-20 mg drug per 0.5 cm2 reservoir patch to elicit 3-day sustained delivery, while compression coating could coat ~35-70 mg drug per 0.5 cm2 reservoir patch to elicit week-long sustained delivery. Besides sustained drug delivery, laser-assisted powder reservoir patch delivery also showed a good safety. Laser-generated skin MCs resealed in 1-2 days and completely recovered in 3 days after the week-long sustained delivery. AFL-assisted powder reservoir patch delivery involves no complex powder formulation and only requires incorporation of highly water-soluble mannitol or a similar excipient to elicit the high-efficient delivery. Enlarging reservoir patch size to 10 cm2 can conveniently expands the delivery capacity to gram scale. To our knowledge, this is the first time that high-dose week-long sustained transdermal delivery of hydrophilic drugs was achieved via a simple laser-based powder delivery platform.

Biography

Dr. Xinyuan Chen is an Assistant Professor in the Biomedical and Pharmaceutical Sciences Department at the College of Pharmacy of the University of Rhode Island. He has an educational background in Biochemistry and Molecular Biology (Nanjing University, China). He has a postdoctoral training mainly in transdermal drug and vaccine delivery and vaccine adjuvant field (Wellman Center for Photomedicine, Massachusetts General Hospital). He is among the firsts to explore laser-assisted powder drug and vaccine delivery. His current research focuses on developing laser-based powder drug and vaccine delivery platforms to improve drug and vaccine efficacy and develop novel physical and improved chemical adjuvants to boost vaccination. Dr. Chen has 22 peer-reviewed publications and 3 book chapters. His research is mainly supported by the National Institute of Health that include K99/R00 Career Development Award, R21 and R01 grants.

Publications

1.Vaccine delivery alerts innate immune systems for more immunogenic vaccination

2.Adjuvantation of Influenza Vaccines to Induce Cross-Protective Immunity

3.Improving immunogenicity and safety of flagellin as vaccine carrier by high-density display on virus-like particle surface

4.Laser facilitates week-long sustained transdermal drug delivery at high doses

5.Augmentation of vaccine-induced humoral and cellular immunity by a physical radiofrequency adjuvant

4th International Conference on Pharmaceutics & Advanced Drug Delivery Systems | Berlin, Germany | April 05, 2021

Citation: Xinyuan Chen, Laser facilitates week-long sustained transdermal drug delivery at high doses, Pharmaceutical Science 2021, 4th International Conference on Pharmaceutics & Advanced Drug Delivery Systems, Berlin, Germany, April 05, 2021