Solid Formulations for Transdermal Delivery via Micro-Fabricated Needles

By

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Abstract

Ever since the day that the Chinese take the boiled tea leaves as refreshing drink, the Egyptian has their first record of celebrating their triumphant return with alcohols, or people from Maya civilization obtain tobacco as the “joy” and “rejoicing”, our human being happens to start on a journey of improving the quality of life. By exploring various materials with medical value, developing techniques to extracting components from raw pieces and changing the route and targets of administration, our knowledge and understanding give us a more and more precise and lusher concept of “drug”. Among all those schools and sects of “drug” exploration, “formulation” and “delivery”, two of the most mentioned words, are the focus of this study. Aiming to protect the drug molecular from the influence of exogenous elements before reaching the target area or to achieve a longer lasting controlled release of effective components, formulation and reformulation is vital and determined to improve the acceptance of drug to human body. Moreover, with its properties of well-concentrated, low risk of inflammation and easy preserved, solid formulations are sharing more and more attention when it comes to formulation selection. This study provides several possibilities of developing solid formulations as reference, which includes: Solid Alginate Micro-Particles (SLNPs), Magnetic Nano-Particles (MNPs), Starch-Granulate-Stabilized Emulsions (SGSEs) and Thermo-Responsive Micro-Gels (TRMGs). Synthesis pathways with materials and methods, characterizations with parameters and instruments and concluding remarks with suggestions will be displayed by each formulation.

A well-designed enteral route of delivery can greatly improve the bioavailability of the applied formulation. In fact, many gateways on the human body are selected for the routes: oral, local, respiratory, parenteral, etc., all of which have their advantages and drawbacks. Among these, transdermal delivery through skin, the largest organ, is an attractive subtitle of research, as a painless but direct administration to circulatory system and immune system can be achieved. In this study, a fabricated needle patch, with microfabrication technique, is developed. A device for transdermal delivery: solid formulation-loaded micro-fabricated needle patch with specific adaptor assembled on a high intensive focused ultrasound (HIFU) source, is designed and prototyped. A series of simulations of transdermal delivery focusing on acoustic-structure interaction are also provided, as theoretical guidelines.