

Development and Physiochemical Characteristics of Vitamin C-loaded Microneedles

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ABSTRACT

Vitamin C, ascorbic acid, is a water-soluble vitamin that is considered as one of the most potent antioxidant agent. It delays early skin aging, protects against harmful free radicals, improves wrinkles appearance under-eye circles, and reduces redness and hyperpigmentation. One of the most common way to deliver vitamin C to the body's tissue is through skin layers. Nevertheless, the effect of such ingredient might be limited due to the stratum corneum barrier which decreases the ability to reach the site of action. In this study, we provide an innovative strategy of utilization dissolving microneedles (MNs) to enhance skin-drug delivery system and overcome problems associated with the conventional formulations. A delivery system of micro-molds which provide a diverse range of three-dimensional (3D) MNs were used for the fabrication of vitamin C patches. Vitamin C MNs were examined for mechanical force tolerance, drug release, dimensional evaluation, dissolution, insertion, and permeation tests. Drug, polymers, and stabilizers were mixed at different ratios. Hydrogels were filled into the molds, centrifuged and left for air dry for 24-48 h. Appearance was visualized under light microscope. Patches were analyzed to determine percent assay of drug loaded, mechanical force, and penetration through the skin. The amount of vitamin C loaded into MNs was found to be 102%. MNs were easily inserted and dissolved through skin within 30 s. The dissolution rate of MNs were tested by using rat skin to determine the release of vitamin C within several time intervals. The in vitro release of vitamin C loaded MNs showed cumulative release percentage up to 70% in 9-10 h. Therefore, MNs as dermal drug delivery system was successfully developed, providing efficient release of vitamin C through the skin.