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Innovative drug delivery system: Drug delivery characteristics by biodegradable microneedle structure

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The microneedle-mediated transdermal delivery system has been developed to be minimal invasive self-administration method for cosmetic, medical device and pharmaceutical fields. Most of the microneedles are fabricated by micro-molding method. Droplet-born air blowing (DAB) method has some advantages in fast and stable fabrication of biodegradable microneedle by drying polymer at room temperature in a few minutes. Additionally, DAB method provides precise control of drug dose in the microneedle by controlling dispensing amount. DAB-based biodegradable microneedle products are already commercialized in various countries. The purpose of this study is to show the characteristics of biodegradable microneedles fabricated by DAB method, which manufactured in our mass production system. We have studied the rheological properties of biodegradable polymers that can be used by the DAB method. We selected the same polymer with different intrinsic viscosity values to confirm the rheological properties of the liquid phase. The characteristics of the microneedle manufactured by DAB method were confirmed. We also fabricated microneedles with these polymers to confirm the characteristics of each microneedle and we made 2 type microneedle. First type is single layer microneedle. Second type is double layer microneedle. We tested protein and chemical drug. The loaded amount of drug was analyzed by enzyme-linked immunosorbent assay (ELISA) or HPLC/UV system. Skin permeability of microneedle was confirmed by OCT (optical coherence tomography) and delivered amount of drug into the skin was analyzed using Franz diffusion cell (Logan, FDC-6T). We optimized the DAB process parameters and scaled up without applying any heat. Various ingredients were loaded within microneedles approximately 100% compared to theoretical values independent of microneedle length. *In vitro* and *ex vivo* studies using Franz diffusion cell showed excellent delivery efficiency compared to topical solution. *In vivo* OCT images clearly showed that whole length of microneedles could penetrate human skin. We are studying the pharmacokinetics of small molecule, biomolecule pharmaceutical products in animal models. DAB technology suggests a way to solve the problems of conventional molding method to fabricate biodegradable microneedle. Based on the method, we have successfully developed mass production system to manufacture microneedle-arrayed patch. We are investigating the formulations for a bio-pharmaceutics using this platform technology.

Biography

Geum Chae Jang has completed her BS degree in Animal Biotechnology and MS degree in the Department of BIN Fusion Technology at Chonbuk National University, Republic of Korea. Her research interests include synthesis of polymeric biomaterials for regenerative medicine and drug delivery system. Currently, she is studying microneedle patch for transdermal drug delivery system at Raphas Co. Ltd.

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