DEVELOPMENT AND PRODUCTION OF MECHANICAL PENETRATION ENHANCERS (MPEs) FROM NATURAL POLYMERS EXTRACTED FROM FISH SCALES

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Effective delivery of topical agents is often limited by the natural barrier in the form of the *stratum corneum*. A method which has been developed to overcome this barrier in a non-invasive manner is the use of micron sized mechanical penetration enhancers (MPEs) or microneedles. Mechanical penetration enhancers have been fabricated from materials such as titanium, polycarbonate and silicon. Polymeric mechanical penetration enhancers offer a variety of advantages over other materials in terms of low cost, safety and biocompatibility. In this study we explored the production of mechanical penetration enhancers from natural polymers extracted from scales of fish. Fish scales have increasingly showed potentials as favourable sources of natural polymers for use in cosmetics, pharmaceutical and biomedical fields. Polymers were extracted by hydrolysis and the films were created using customized silicon substrates. MPEs were formed using microfabrication technique and visualization of the MPEs showed that M.P.Es with conical structures was successfully formed. Mechanical analyses of the films using texture analyser showed the derived polymer to possess young modulus, elongation at yield and tensile strength comparable to those of synthetic polymers that are currently used for fabrication of mechanical penetration enhancers. The mechanical properties obtained from experiment were incorporated into finite element simulations for theoretical analysis of skin insertion force of the penetration enhancer. The results show that the mechanical penetration enhancers fabricated using the extracted polymer can successfully pierce the *stratum corneum* without fracture. This study provides evidence that natural polymers obtained from fish scales can be used to fabricate mechanical penetration enhancers for enhanced delivery of topical formulations. Future studies will look at analyses of the microstructure of the polymer, reinforcing with other materials and transport studies on skin models.