Synopsis of Original Research Paper

# Transdermal delivery system of cytokines by calcium phosphate nanoparticles

**Maki Nakamura**

*Nanomaterials Research Institute, National Institute of Advanced Industrial Science and Technology (AIST)*

Transdermal delivery system of cytokines by calcium phosphate (CaP) nanoparticles would be useful in the cosmetic and medical fields. In this study, we aimed to fabricate CaP nanoparticles containing a clinically approved cytokine, basic fibroblast growth factor (FGF-2). First, we used cytochrome C as a model basic protein, which has similar characteristics (isoelectric point and molecular weight) to FGF-2. Negatively charged heparin was co-immobilized within CaP nanoparticles as a dispersant. The CaP nanoparticles immobilizing both cytochrome C and heparin were fabricated from a reaction solution containing calcium ions, phosphate ions, carbonate ions, heparin, and cytochrome C. The immobilization efficiencies of cytochrome C in the CaP nanoparticles with heparin were about three times higher than those in the CaP nanoparticles without heparin, indicating that heparin improved immobilization efficiencies of cytochrome C within CaP nanoparticles. This might be due to the interaction between negatively charged heparin and basic protein, cytochrome C. The role of heparin as a dispersant was also confirmed: the cytochrome C–CaP nanoparticles with heparin were dispersed in water, whereas those without heparin did not. Next, we fabricated CaP nanoparticles immobilizing both FGF-2 and heparin in the same manner. The resulting nanoparticles slowly released FGF-2 in a culture medium for at least two days. These results indicate the potential of the resulting nanoparticles as cosmetic and medical materials, which are capable of releasing FGF-2.