- Application Note -

Title

Analysis for composite biomaterial of polycaprolactone and tricalcium phosphate with Raman spectroscopy

Introduction

Polycaprolactone is well known for biodegradable polymer and used as a material for scaffold in tissue engineering. Tricalcium phosphate is also known for bioabsorbable tribasic calcium and phosphate and affect positively on bone tissue regeneration. In many studies, the composite material of polycaprolactone and tricalcium phosphate has excellent effect on bone tissue regeneration. The polycaprolactone and tricalcium phosphate are white colored both therefore it is difficult to know the dispersion of tricalcium phosphate in polycaprolactone with a microscope. Raman spectroscopy is a nondestructive analysis method and can easily identify the materials without sample preparation. Here, we observed composite material of polycaprolactone and tricalcium phosphate with confocal Raman spectroscopy system, XperRam C series.

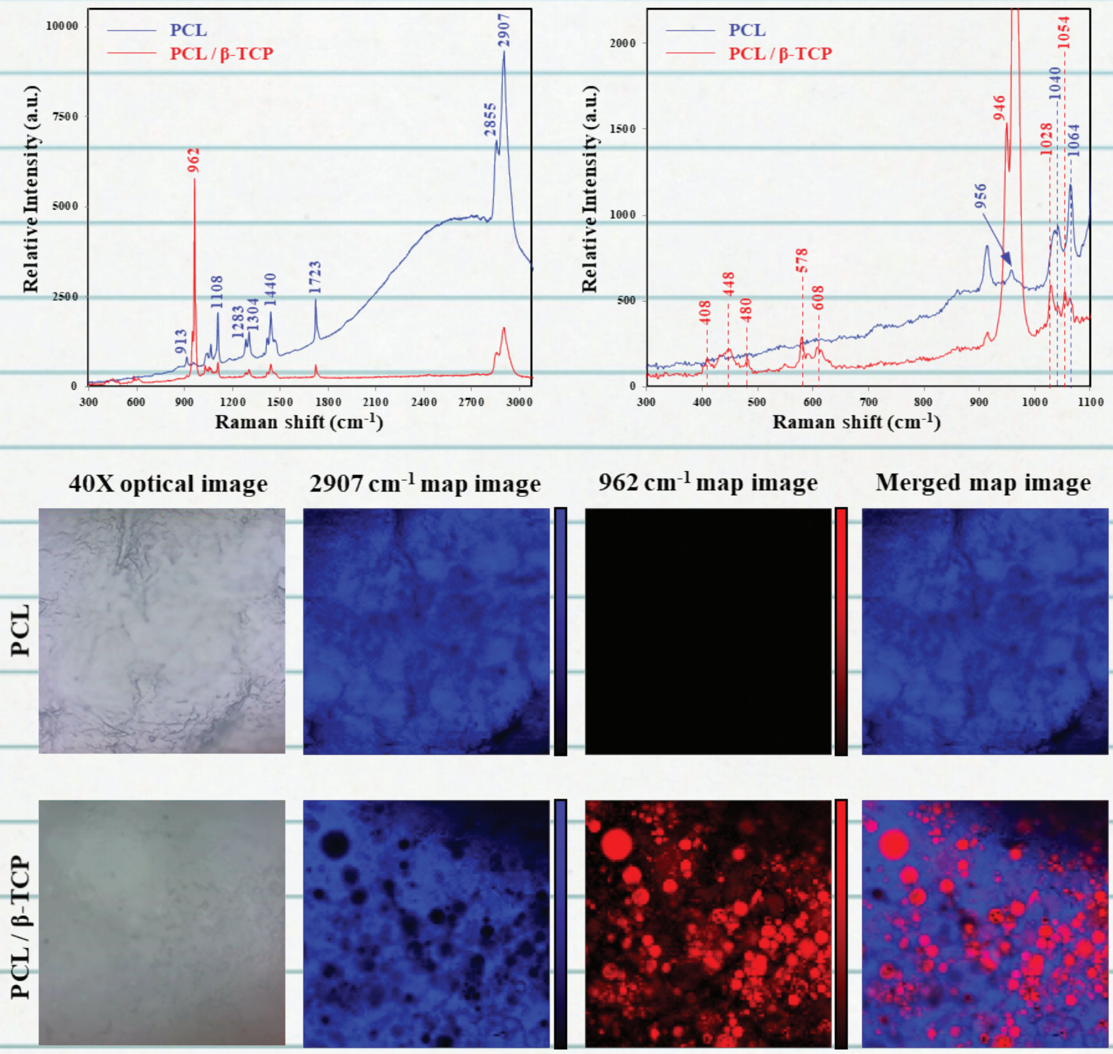
Mateirlas & Methods

Composite material (PCL-TCP) of polycaprolactone (PCL) and tricalcium phosphate (TCP) were prepared by melt-blending technique. Raman spectrum and Raman images of PCL and PCL-TCP were obtained with confocal micro-Raman spectroscopy instrument, **XperRam C series (XperRam C5)**. Especially, Raman imaging was performed at phoisphate symmetric stretching vibration of calcium (962 cm^{-1}) and CH stretch band (2907 cm^{-1}) for detecting TCP and PCL each. To evaluate the dispersion of TCP in PCL, two Raman images of phosphate symmetric stretching vibration of calcium and CH stretch band were merged. The Raman imaging area was 100 μm × 100 μm and step size was 1 μm.

Conclusion

Averaged Raman spectra of each membrane were measured by XperRam C5 (Figure). Blue-labeled peaks show typical vibration modes of PCL. Red-labeled peaks are considered as intrinsic peaks of TCP. Any componential difference wasn't found in optical images. However, PCL-TCP was distinguished clearly through Raman map image in comparison to PCL membrane. At merged map image, highly well-blended TCP particles were exhibited in PCL membrane. Consequently, this result proves that Raman spectroscopy is a powerful and effective tool to evaluate composite biomater- ials. These composite biomaterials can be used as 3D-printed bioscaffold which have abilities at guided tissue regeneration. Furthermore, Raman spectroscopy shows the possibility of numerous applications in biomaterials.

Figure



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