JOURNAL OF Applied Polymer SCIENCE

Poly(ε-caprolactone) Composites Containing Gentamicin-Loaded β-Tricalcium Phosphate/Gelatin Microspheres as Bone Tissue Supports

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ABSTRACT: In this work, novel antibacterial composites were prepared by using poly(ε-caprolactone) (PCL) as the main matrix material, and gentamicin-loaded microspheres composed of β-tricalcium phosphate (β-TCP) and gelatin. The purpose is to use this biodegradable material as a support for bone tissue. This composite system is expected to enhance bone regeneration by the presence of β-TCP and prevent a possible infection that might occur around the defected bone region by the release of gentamicin. The effects of the ratio of the β-TCP/gelatin microspheres on the morphological, mechanical, and degradation properties of composite films as well as *in vitro* antibiotic release and antibacterial activities against *Escherichia coli* and *Staphylococcus aureus* were investigated. The results showed that the composites of PCL and β-TCP/gelatin microspheres had antibacterial activities for both bacteria. © 2012 Wiley Periodicals, Inc. J. Appl. Polym. Sci. 000: 000–000, 2012

KEYWORDS: poly(ε-caprolactone); β-tricalcium phosphate; gelatin; fillers; biodegradable; controlled release; antibacterial activity

Received 10 October 2011; accepted 19 March 2012; published online
DOI: 10.1002/app.37770

INTRODUCTION

Composite systems are becoming more popular in biomedical applications because of the effective combination of the desired properties of their constituents. From this perspective, inorganic bioceramic fillers and biocompatible polymer matrices are one of the mostly developed systems for orthopedic and dental applications. These systems have osteoconductive and osteoinductive properties as well as good mechanical strength of bioceramics and high biocompatibility and processability of polymers.[1] One of the application areas of such composites as two-dimensional film forms is guided bone regeneration (GBR), which is a promising therapy to repair mandible and alveolar bone defects suffered by periodontal diseases and applied at dental implant sites.[2] The commercially available GBR membranes are made of polymers, including nondegradable polytetrafluoroethylene (PTFE) and biodegradable polylactide, polyglycolide, polycarbonate, and collagen.[3] Although PTFE membranes have been indicated satisfactory clinical results, biodegradable polymer-based GBR membranes have been studied increasingly in the recent years because of the nonrequirement of second surgical procedure to remove the membranes.[3–5] Among many biodegradable polymers, poly(ε-caprolactone) (PCL) is a well-established one in tissue engineering studies owing to its biocompatible, biodegradable, and mechanical properties. Recent studies on PCL and its composites with bioactive inorganics have shown desired osteoblastic responses in *in vitro* experiments and good tissue interactions in *in vivo* conditions.[6,7]

Local application of antibiotic release systems is important for hard tissue engineering because of both poor vascularity in bone tissue for oral or intravascular therapy and easiness of microbial attack in dental sites where it is open area to environment.[8,9] Various microsphere systems prepared from biodegradable synthetic and natural polymers have been studied as antibiotic-carrying vehicles by many researchers, and it has been proposed that both the ability of controllable release and the