

## **Influence of Biomimetically Mineralized Collagen Scaffolds on Bone Cell Proliferation and Immune Activation**

Lucie Bačáková, Katarina Novotná, Daniel Hadraba, Jana Musílková, Petr Slepíčka, Miloš Beran

### Abstract

Collagen, as the main component of connective tissue, is frequently used in various tissue engineering applications. In this study, porous sponge-like collagen scaffolds were prepared by freeze-drying and were then mineralized in a simulated body fluid. The mechanical stability was similar in both types of scaffolds, but the mineralized scaffolds (MCS) contained significantly more calcium, magnesium and phosphorus than the unmineralized scaffolds (UCS). Although the MCS contained a lower percentage (~32.5%) of pores suitable for cell ingrowth (113–357  $\mu\text{m}$  in diameter) than the UCS (~70%), the number of human-osteoblast-like MG-63 cells on days 1, 3 and 7 after seeding was higher on MCS than on UCS, and the cells penetrated deeper into the MCS. The cell growth in extracts prepared by eluting the scaffolds for 7 days in a cell culture medium was also markedly higher in the MCS extracts, as indicated by real-time monitoring in the sensory xCELLigence system for 7 days. From this point of view, MCS are more promising for bone tissue engineering than UCS. However, MCS evoked a more pronounced inflammatory response than UCS, as indicated by the production of tumor necrosis factor-alpha (TNF- $\alpha$ ) in macrophage-like RAW 264.7 cells in cultures on these scaffolds.

**Keywords:** biopolymers; nature-derived polymers; porous scaffolds; mechanical properties; elemental composition; regenerative medicine; cell adhesion; cell growth; cell differentiation; inflammatory activation

Polymers 2022, 14(3), 602.

<https://doi.org/10.3390/polym14030602>