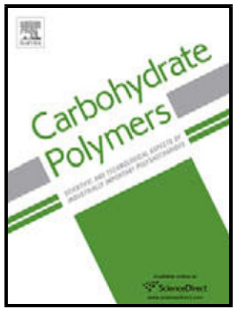

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Alginate-polymethacrylate hybrid hydrogels for potential osteochondral tissue regeneration

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Highlights

- Alginate-polymethacrylate hybrid hydrogels are achieved by a simple procedure
- Formation of a double ionic and covalent interconnected network is envisaged
- Mechanical performance of the hybrid hydrogels is enhanced due to the double network
- Swelling ratio and crosslinking degree are correlated to the hydrogel properties
- From hybrid hydrogels scaffolds suitable for osteochondral regeneration are obtained

ABSTRACT

Porous scaffolds based on alginate-polymethacrylate hybrid hydrogels intended for bone and cartilage regeneration were prepared through controlled calcium ions diffusion from an agar mould. The double interconnected network of such materials combines into a single porous structure maintained by both noncovalent crosslinks (calcium ions for alginate) and covalent crosslinks (polymethacrylate crosslinked by the addition of mixtures of mono and bifunctional monomers). The alginate component ensures the appropriate micro-environment to mimic the extra-cellular matrix, whereas the polymethacrylate improves the mechanical performances of the hybrid hydrogels, helping to overcome the mechanical limitations of the alginate component. Morphological characterization and porosity analysis of the hybrid scaffolds were assessed by scanning electron microscopy and micro-computed tomography. Relative concentration and distribution of calcium ions were evaluated by atomic absorption and dispersive X-ray analysis, respectively. Uniaxial compressive mechanical tests were conducted to evaluate the compressive elastic modulus of the hybrid hydrogels that was correlated with their swelling ratio and crosslinking degree. As was envisaged a much higher modulus (about seven times) was obtained for the hybrid Alg/HE hydrogel than with alginate alone.