Fabrication of Bone Tissue Scaffolds by Chitosan Microspheres Agglomeration

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Introduction
In herby work authors present chitosan microspheres’ aggregation as a potential method for bone tissue substitutes fabrication.

Materials and Methods
In presented here method scaffolds’ fabrication process was multistage and consisted of the following steps: spheres extrusion, pH neutralization, matrix formation by compressing and bonding the spheres using solvent and cross-linking agents, rinsing and drying. The most important part of the process was the spheres bonding. Microspheres got stuck together in presence of solvent and STPP (sodium tripolyphosphate) as cross-linking agent influence. The acetic acid dissolved external surfaces of the spheres to make them bond together. Microspheres were manufactured with the use of high molecular weight chitosan with DD about 70%. Spheres were produced by using 4% w/v chitosan solution in 5% v/v orthophosphoric acid. Spheres were extruded using infusion pump to precipitation bath. They were produced with constant speed, while precipitation bath was continuously blended. Dried microspheres were placed in syringe, poured with the acetic acid and compressed between plungers, optionally subjected to STPP treatment, then they were neutralized if necessary, washed and dried. Authors studied the influence of STPP concentration and time of cross-linking process on scaffolds morphology, physical and biological properties.

Results
The technique, presented above allows to generate porous materials with controllable shape, pore size distribution and their interconnectivity (Fig.1). Volumetric porosity of fabricated materials equals about 40%. Both spheres’ diameters and scaffolds’ dimensions may be adjusted to existing needs by using different size of needle and another moulder for samples’ shape.

Discussion and Conclusions
We found that due to polyphosphates presence scaffolds tend to have more compact and tight structure. Cross-linked materials appeared to have almost two times higher Young module. Cells’ culturing also produced satisfactory results. MG63 revealed morphology typical for correctly developing osteoblasts. There was no toxic effect observed.