DESCRIPTION FOR THE GENERAL PUBLIC(IN ENGLISH)

Large bone defects treatment caused by trauma or tumor, cyst resection is the big challenge for modern medicine. Due to the acceleration of the pace of life and the aging society, the situations mentioned before are getting increasingly frequent. Calcium phosphate cements are the group of materials used as remedy in the above situations. Cements are not only used as fillers but also as fixation of implants (eg. endoprosthesis). Other applications include bone spinal fillings (vertebroplasty and kyphoplasty) and fracture stabilization.

An ideal bone substitute must have many properties attributed to the autologous transplanted tissue. Features such as biocompatibility, osteoconductivity, bioactivity (interaction with the site of implantation, leading to the release and exchange of ions and gradual biodegradation) are desired. The implant should also allow to regenerate not only the bone tissue itself, but also promote its vascularization. The process of tissue vascularization is called angiogenesis. To make it happen, new forming bone should be constantly supplied with nutrients. For this purpose, materials used in bone substitution should have adequate **porosity**. The pores must be easily accessible to the blood vessels. In other words, the pores must be larger than 50 μm and preferably interconnected. The biomimetic approach in bone tissue engineering requires the use of specialized **macroporous scaffolds**..

Scaffolds obtained during the project may prove to be good candidates for bone tissue engineering. Tissue engineering is an interdisciplinary field that combines the principles of engineering and natural sciences to develop substitutes or to restore, maintain or improve the function of physiological tissues. In innovative tissue engineering approaches, autologous cells can be grown in vitro on biocompatible scaffolds based on synthetic and / or biological biomaterials and grafted back to the patient, thus reconstructing the autologous bone without the need for tissue explants.

The main goal of this project is surfactant-assisted fabrication and evaluation of novel, highly porous, chemically bonded scaffolds based on α-TCP (one of calcium phosphates) for bone tissue engineering. The influence of the kind and amount of used surfactant will be assessed.

Surfactants (surface active agents) that should significantly improve some properties have been fairly poorly researched in the field of bone cements. In general, surfactants stabilize foam at the water-air interface, reducing the energy required to maintain a larger interfacial area associated with the formation of air bubbles. This process can be used to produce porous cement-type scaffolds.

The main hypothetical assumption is that by adding the surfactant in the right amount it will be possible to obtain a developed macroporosity and accelerated degradation rate of the bone cement. It can also be hypothesized that the addition of surfactants with antibacterial properties to cement pastes will provide these properties to the final cements.

A new generation of potentially bioactive, bioresorbable biomaterials with developed macroporosity and possible additional biological activity will be prepared and evaluated.

Knowledge derived from the proposed project will be a significant step forward in biomaterials research as well as will support future designing of bone cements with a foreseen properties according to specific predefined needs.