P64

Functionalization of PU-based materials for orthopedic applications

K. Athanasopulu[1], *R. Kemkemer[2,1], G. Lorenz[1], L. Kutuzova[1]
[1]Hochschule Reutlingen, Reutlingen, Deutschland
[2]Max-Planck-Institut für Intelligente Systeme, Stuttgart, Deutschland

Knee osteoarthritis is a common complication and can lead to total loss of joint function in patients. Treatment by either partial or total knee replacement with appropriate UHMWPE based implantsis highly invasive, may cause complications and may show unsatisfying results. Alternatively, treatment may be done by insertion of an elastic interpositional knee spacer with optimized material characteristics.

We report the development of high performance polyurethane-based polymers modified with bioactive molecules for fabrication of such knee spacers. In order to tailor mechanical and tribological properties and to improve resist to enzymatic degradation we propose a core-shell model for the spacer with specifically adapted properties.

The shell material modification has been development with two different strategies (Fig.1) by incorporating native and sulfated hyaluronic acid into the core model via bulk polymerization or covalent surface tethering. The surface structure and morphology was analyzed by electron microscopy (SEM), contact angle measurements and other methods.

The proposed construct has a core material based on polycarbonate urethane surrounded with long polydimethylsiloxane (PDMS) chains with low water uptake and high mechanical stability. The shell is modified with hydrophilic hyaluronic acid components to provide bioactivity. First in-vitro tests with chondrocytes demonstrate the biocompatibility.

Figrue 1: Strategy to modify polyurethane-based shell material with hyaluronic acid

Acknowledgement

Financial support of this project by the German Federal Ministry of Education and Research (BMBF) under grant number 01EC1406C (TOKMIS) is gratefully acknowledged

References

[1] Makris E.A. et al. (2011), Biomaterials 32(30):7411-7431
[2] Gong F. et al. (2010), International Journal of Polymer Science , 8p
[3] Magnani A. et al. (1999), J. Mater. Chem., 9:2393-2398

Abb. 1