New Materials with Potential Biomedical Applications

Suomen Akatemia (Academy of Finland)

Bisphosphonates are a group of compounds that have become well-known and are extensively used as drugs for treating bone-related diseases, such as osteoporosis. New uses for bisphosphonates were discovered, as their ability to form physical gels in pure water was reported for the first time in a recent study performed in collaboration with the Finnish Universities of Jyväskylä and Eastern Finland.

The gelation tendencies of four bisphosphonates were studied in detail under the baton of Academy Research Fellow Elina Sievänen and her group at Department of Chemistry of University of Jyväskylä. Moreover, the structures of the formed gels were investigated in detail by a wide selection of methods. Docent Manu Lahtinen from Department of Chemistry of University of Jyväskylä contributed significantly in the structural analysis part of the study. The examined bisphosphonates were designed and prepared under the supervision of Professor Jouko Vepsäläinen at the School of Pharmacy of the University of Eastern Finland (Kuopio Campus). The study is part of the doctoral thesis of postgraduate student Aino Alanne from the School of Pharmacy of the University of Eastern Finland.

The current study increases our understanding of the factors affecting on processes leading to gelation and may provide new materials for innovative applications in biomedicine. This kind of materials could, for example, serve as substitutes to restore, maintain, and/or improve the function of bone tissue. Moreover, they might act as scaffolds to mimic the extracellular matrix and provide support for cell adhesion, migration, and proliferation.

The study was published in the prestigious international Journal of Materials Chemistry B: Materials for biology and medicine, and the article was featured in the cover art of issue 45 (2013).

Supramolecular Gels Are Responsive and Reversible

Physical, also known as supramolecular, gels form when low molecular mass compounds interact with one another by forming a network, which finally adsorbs the solvent into its structure. Supramolecular gels differ from the traditional chemical (polymeric) gels as being reversible. They can be subjected to a stimulus, e.g. heating, to which they respond by changing forms. After the exposure ceases, the gel is re-formed.

Supramolecular gels have several applications in materials chemistry and optoelectronics. Furthermore, biomaterials based on supramolecular gels may find use in biomedicine, drug delivery, and regenerative medicine.

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