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Influence of mechanochemical treatment on thermal and structural properties of silica-collagen and hydroxyapatite-collagen composites. Part I

J. Skubiszewska-Zięba[1], E. Skwarek[1], B. Charmas[1], N. Zając[1], V.V. Sydorchuk[2]

[1] Faculty of Chemistry, Maria Curie-Sklodowska University, M. Curie-Sklodowska Sq. 3, 20-031 Lublin, Poland
E-mail: jskubisz@poczta.umcs.lublin.pl

2 Institute for Sorption and Problems of Endoecology ,National Academy of Sciences of Ukraine Ukraine, 13 General Naumov Streat, Kiev 03164, Ukraine

In bone tissue engineering collagen and hydroxyapatite (HAp), have enormous potential as biomaterials because of their accessibility, biocompatibility, the ability to connect with other materials, ease of processing, assimilation in the body and much more. Bone belongs to the tissue family with a complex structure organized hierarchically. This tissue consists of 70-80% w/w of mineral part (mainly hydroxyapatite) and 20-30% w/w of other components (mainly collagen). One of the main challenges to bone tissue engineering is to develop scaffolds with optimal mechanical, functional and architectural properties to create the favorable conditions for cell colonization and organization, which can ensure the integration of the scaffold with the host tissue.

In tissue engineering there is a wide range of proposals for obtaining such collagen and hydroxyapatite based scaffolds, and also with other additives such as metals, fibers (carbon, glass, polymers) and others.

The aim of this work was to study the use of mechanochemical processing (MChT) to produce the collagen-hydroxyapatite and collagen-silica composites of 30/70 w/w ratio. MChT processes were performed at different rotations of mill (200 and 400 rpm) and various periods of time (30, 60 and 120 min).

It was found that at rotations of 200 rpm, the specific surface area (S_{BET}) and pore volume (V_p) decrease both for individual substances (HAp and SiO_2) and for their composites with collagen. But at 400 rpm, SiO_2-collagen composites had higher S_{BET} and V_p values than SiO_2 treated individually. On basis of this, it can be assumed that under these conditions a new structure has been created. The impact of MChT treatment conditions on the other parameters of the obtained composites with respect to these data for individual substances has also been found.