Synthesis of zinc-containing hybrid materials for medical use

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Zinc is a bioactive element, which takes part in cell division, differentiation, reparation, and in formation of T-cell immunity. It is included in different enzymes and plays an important role in the processes of skin regeneration, hair and nail growth. There is a growing interest in designing delivery agents of this element with high bioavailability for human organism. In particular, slow release forms are needed. The purpose of this work was to synthesize zinc-containing hybrid materials capable of slowly releasing zinc.

We have synthesized Zn-MOF-5 from terephthalic acid and zinc acetate using optimized technique. This included optimization of the ratio and concentrations of the precursors selected. The reproducibility of the synthesis was confirmed. The synthesis was carried out in a Milestone Ultraclave III unit with microwave heating at the argon pressure of 40 atm. The resulting crystalline product was characterized by XRD and SEM methods. (Fig.1,2)

Figure 1. XRD of Zn-MOF-5

Figure 2. SEM of Zn-MOF-5

As the second form of slow release Zinc, complexes with humic substances were synthesized: zinc nitrate and sulfate were used as precursors. The Zn-humics complexes were synthesized by mixing the precursors at room temperature. The combination of XRD and EXAFS data confirmed the formation of zinc humate complexes.

The obtained Zn-containing materials could become a source of slow-release Zn ions for wound healing and other medical applications alternative to a use of zinc oxide. In the future, experiments will be carried out on zinc release rate determination from the obtained preparations. Also, experiments to identify the wound-healing properties of these preparations are planned.

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