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Application of Metal-Organic Framework containing Hydroxyapatite(MOF/HAp) in Tissue Engineering to improve Bone function

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Today, tissue engineering has been given much attention in order to restore damaged tissues, especially bone tissue, and improve its function. For the regeneration of bone tissue, a scaffold with biological and biochemical properties is needed that can have high biocompatibility and porosity that can simulate the natural bone tissue [1]. Hydroxyapatite has a chemical composition similar to the mineral part of teeth and bones, which gives them properties such as hardness and strength. On the other hand, it is possible to use the metal-organic framework (MOF), which is a three-dimensional network of metal ions connected by multidentate organic molecules, along with hydroxyapatite, which creates features such as increased surface area, flexibility, and structural diversity. One of the metal-organic frameworks is zinc-based zeolite-imidazolate framework (ZIF-8), which has small-sized particles, high specific surface area, and stable release performance, and also has antibacterial properties due to the release of zinc ions, which is useful for tissue repair. Bone is used along with hydroxyapatite [2,3]. In order to prepare the desired composite zinc nitrate hexahydrate, 2-methyl imidazole(2-MIM) and hydroxyapatite powder were dissolved separately in methanol and after complete dissolution, they were added to each other. Finally, after the dissolution of the sediment was complete formed was used as the desired composite. considering this issue, in this study, a metal-organic framework composite containing hydroxyapatite was successfully synthesized and characterized for potential applications. Structural and crystalline characteristics of synthesized composite were evaluated using Fourier transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD). The peaks in the FTIR spectrum proved the presence of Hap on MOF. Morphological investigation using scanning electron microscope (SEM) showed that the average particle size is~20.3nm, and the elemental composition of synthesized product by EDS analysis exhibits the presence of Zn,N,P,Ca,O and H atoms, confirming the successful synthesized. The results showed that the use of composite containing MOF/Hap has a potential application in improving bone tissue.

Keywords: Bone tissue engineering, Hydroxyapatite, Nanofibrous composite, Metal-organic framework

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