Proceedings of the Canadian Society for Mechanical Engineering International Congress 2021
CSME Congress 2021
June 27-30, 2021, Charlottetown, PE, Canada

The effect of a novel in situ akermanite-monticilite nanocomposite on osteogenic differentiation of mouse mesenchymal stem cells

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ABSTRACT

Different materials, as bioactive materials such as bioceramics, have been synthesized for biomedical applications. Akermanite (Ca2MgSi2O7) is one of the Si, Ca, and Mg containing ceramics that have been mainly utilized in bone tissue engineering. Akermanite conventionally, synthesized by the sol-gel method, requires high temperature (~1300 ˚C) to calcinate. In this study, we synthesized in situ akermanite-monticilite nanocomposite using sol-gel and mechanical activation to overcome the challenges, and calcination temperature reduced significantly from 1300 down to 1100˚C. We evaluated the phase formation process using XRD, and the results showed that mechanical activationn has a significant role in the construction of nanocomposite. By increasing the time of mechanical activation, the weight percentage of the monticilite phase increased. Extract of bioceramic also showed substantial osteogenic property. Alizarin Red staining results demonstrated that calcium deposition of MSCs was increased when the bioceramic extract diluted the osteogenic media. This observation was consistent with the works of literature. Si ions that were released form bioceramic enhanced the rate of the differentiation.