A Novel Approach for Synthesis of Monticellite (CaMgSiO₄) Based Bioactive Ceramic Powders Obtained from Boron Derived Waste

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Over the last decade, Ca-, Mg- and Si-containing bioactive ceramics have received much attention as bone graft substitutes due to high bioactivity and osteoconductivity, leading formation of a bone-like apatite layer and then strong implant-bone bond. Among the bioactive ceramics belong CaO-MgO-SiO₂ triple oxide system, monticellite (CaMgSiO₄) bioactive ceramics have a high usage potential for bone void filling and coating on Ti-6Al-4V alloy due to higher fracture toughness and much closer Young’s modulus to that of cortical bone than hydroxyapatite (HAp) and excellent bioactivity resulting of Ca, Si and Mg ion dissolutions.

Turkey has 73 % of the boron reserves in the worldwide and annually 600 thousand tons boron derived wastes are emerged during the production of boron products. Increment of amount of waste causes waste storage problems and environmental pollution. In order to find a solution to mentioned problems, the eco-friendly and cost-effective monticellite (CaMgSiO₄) based bioactive ceramic powders were synthesized by thermal process using boron derived waste. Monticellite phase which is stable at 1450°C and above at normal conditions was able to obtain at too low temperature as 650°C during experiments. In addition, the bioactivity assessment of monticellite based bioactive ceramic powders was carried out by in vitro tests.

Keywords: Monticellite (CaMgSiO₄), Bioactive Ceramics, Boron Derived Waste, Powder Synthesis, In Vitro.