**Synthesis of Hydroxyapatite/Bioglass Composite Nanopowder Using Design of Experiments**

## ABSTRACT

Composite scaffolds of hydroxyapatite (HAp) nanoparticles and bioactive glass (BG) were applied as an appropriate selection for bone tissue engineering. To this end, HAp/BG composite was synthesized by a hydrothermal method using Design of Experiments (DOE) with a combined mixture–process factor design for the first time. The input variables were hydrothermal temperature at three levels (i.e., 100, 140, 180 °C) as a process factor and two mixture components in three ratios (i.e., HAp 90, 70, 50; BG 50, 30, 10). The degree of crystallinity and crystal size in the composite were the output variables. XRD showed that only a small fraction of BG was crystallized and that a wollastonite phase was produced. The XRD results also revealed that incorporation of Si into the HAp structure inhibited HAp crystal growth and restricted its crystallization. The FTIR results also showed that the intensity of the hydroxyl peak decreased with the addition of silicon into the HAp structure. DOE results showed that the weight ratio of the components strongly influenced the crystal size and crystallinity. SEM and FTIR results identified the greatest bioactivity and apatite layer formation in the Si-HAp sample with an HAp70/BG30 ratio after 14 days immersion in simulated body fluid (SBF) solution, as compared to other ratios and HAp alone. Therefore, the combination of HAp and BG was able to yield a HAp/BG composite with significant bioactivity.