Abstract

This work focuses on studying the addition effect of the prepared HA powder as a filler material before and after the calcination process with different volume fractions (2.5, 5, 7.5, 10, 12.5, 15) vol% to the unsaturated polyester resin matrix. Many mechanical and physical tests were used to determine the properties of the prepared composite material which involved tensile strength, the modulus of elasticity, the elongation percentage at break, compression strength, compression modulus, bending strength, impact strength, fracture toughness, hardness and water absorption percentage.

For the prepared HA powder, the Ca/P ratio was increased after the calcination process from 2.45 to 2.51. X- ray diffraction patterns for the prepared HA powder before and after the calcination process revealed an increase in the HA peak intensity after the calcination process. Secondary phases also appeared after the calcination process like (α- $Ca_3(PO_4)_2$) and (β- $Ca_2P_2O_7$).

For the prepared composite material with both groups of HA filler particles, the results had shown that the mechanical properties which included: tensile strength, modulus of elasticity, compression strength, compression modulus, bending strength, fracture toughness and hardness have been increased with increasing volume fraction of HA filler particles and reached their maximum value at (7.5 vol%). Furthermore, the increasing in volume fraction revealed a decreasing in the evaluated properties.

Both the elongation percentage at the break point and the impact strength decreased with increasing volume fraction of HA filler particles.

The water absorption percentage as a physical property for the prepared composite material showed an increase with increasing volume fraction of HA filler particles.

The improvement of unsaturated polyester resin with calcined HA filler particles had shown greater values for the fore-mentioned properties than the improvement of unsaturated polyester resin with uncalcined HA filler particles.