Abstract

As concerns are increasing about amalgam consuming, application of new dental material grows more attention. Among them, glass ionomer cement (GIC) have been in the center of attention due to its non-polymeric toxicity and ion release. From material point of view, glass ionomer cements are composites made of a polymeric matrix and glass particles as reinforcements. Poor mechanical properties of glass ionomer cements create doubts about their vivo application. Furthermore in recent years wide searches has been done in order to propose new GICs which represent better mechanical properties. Compositional and structural properties of glasses which are used as reinforcing material are playing an important role in lateral behavior of cement. Regarding this fact, the main purpose of this research is to improve GIC mechanical properties with specific attention to the chemical composition of glass particles. The base chemical composition which has been used in this research is SiO_2-Al_2O_3-P_2O_5-CaO. According to anti-bacterial properties of ZnO, this oxide has been added as a variant to the base glass system. The main purpose of the following research has been divided into two step: the first step is to produce and study glass particles using Fourier-transform infrared spectroscopy (FTIR), Differential thermal analysis (DTA), Raman spectroscopy and Vickers micro hardness. The second phase related to prepare cements with produced glass particles and study them using Diametral tensile strength (DTS), Vickers micro hardness and fractographic investigation using Scanning Electron Microscopy (SEM). Results reveal that increasing ZnO up to 0.25 mole in glass system leads to better chemical durability and better mechanical properties for both glass particles and cement. The Mullite crystallization temperature of glass system increased from 825 to 875 centigrade. Vickers micro hardness of glasses varied from 677 to 816 Hv which is contributed to a more condensed glass structure and better mechanical properties. DTS values increased from 8.39 to 10.53Mpa. Weibull modulus which is a representative of variance in the results has been improved from 2.84 to 16.24. It also affects cements hardness from 95.1 to 131.7Hv. The produced cements can be compared as a powerful cement compared to commercial ones.