

Abstract

Laser-induced breakdown spectroscopy (LIBS) technique has been employed for the plasma characterization as well as for the quantitative analysis of silver dental amalgam. The targets has been exposed to various Nd: YAG laser irradiances ranging from 6.6 TW/cm² to 10.7 TW/cm² under ambient environment of argon at a pressure of 25 torr. The electron temperature of amalgam plasma has been evaluated by employing both Boltzmann and Saha-Boltzmann methods. It varies from (6368 ±5) K to (7445 ±5) K and shows an increasing trend with increasing laser irradiances. The electron number density deduced from the Stark-broadened line profiles varies from 1.1x10¹⁸ cm⁻³ to 1.3x10¹⁸ cm⁻³ and decreases with increasing laser irradiances. The Calibration Free (CF) LIBS method has been used for elemental analysis of silver dental amalgam. Certified concentrations of Ag, Sn, Cu are 45%, 31% and 24% respectively, whereas, their calculated concentrations come out to be 47%, 30% and 23%. The relative errors observed for Ag, Sn, Cu are 0.04%, 0.02% and 0.04% respectively. In order to investigate the surface modifications and to evaluate the ablated areas and ablation depth of silver amalgam after ablation, SEM and Optical Microscopy analyses have been performed. At the lowest irradiance, the uplifting cones and island have been observed, whereas tubules with macro-cracks are observed at the maximum irradiance. The micro-hardness test has been performed by using Vickers hardness tester for the investigation of mechanical properties of the material. The micro-hardness initially increases with increasing irradiances and then decreases at the highest irradiance.