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Determination of carcinogenic fluorine in cigarettes using pulsed UV laser-induced breakdown spectroscopy
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Abstract
A spectrometer based on pulsed UV laser-induced breakdown spectroscopy (LIBS) and a highly sensitive intensified charged coupled device camera was developed to determine the carcinogenic substances like fluorine in various brands of cigarettes available commercially. In order to achieve the high sensitivity required for the determination of trace amounts of fluoride in cigarettes and eventually the best limit of detection, the experimental parameters (influence of incident laser energy on LIBS signal intensity and time response of plasma emission) were optimized. In addition, the plasma parameters like electron temperature and electron density were evaluated using Boltzman's plot for cigarette tobacco for the first time. To the best of our knowledge, LIBS has never been applied to determine the fluorine concentration in cigarettes. Along with the detection of fluorine, other trace metals like Ba, Ca, Ni, Cu, and Na were also detected in cigarettes. For determination of the concentration of fluorine, calibration curve was drawn by preparing standard samples in various fluoride concentrations in tobacco matrix. The concentration of fluorine in different cigarette tobacco samples was 234, 317, 341, and 360 ppm respectively, which is considered to be much higher than the safe permissible limits. The limit of detection of our LIBS spectrometer was 14 ppm for fluorine. © 2015 Optical Society of America.

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