Spectroscopic Analysis of Aerosolized Drugs

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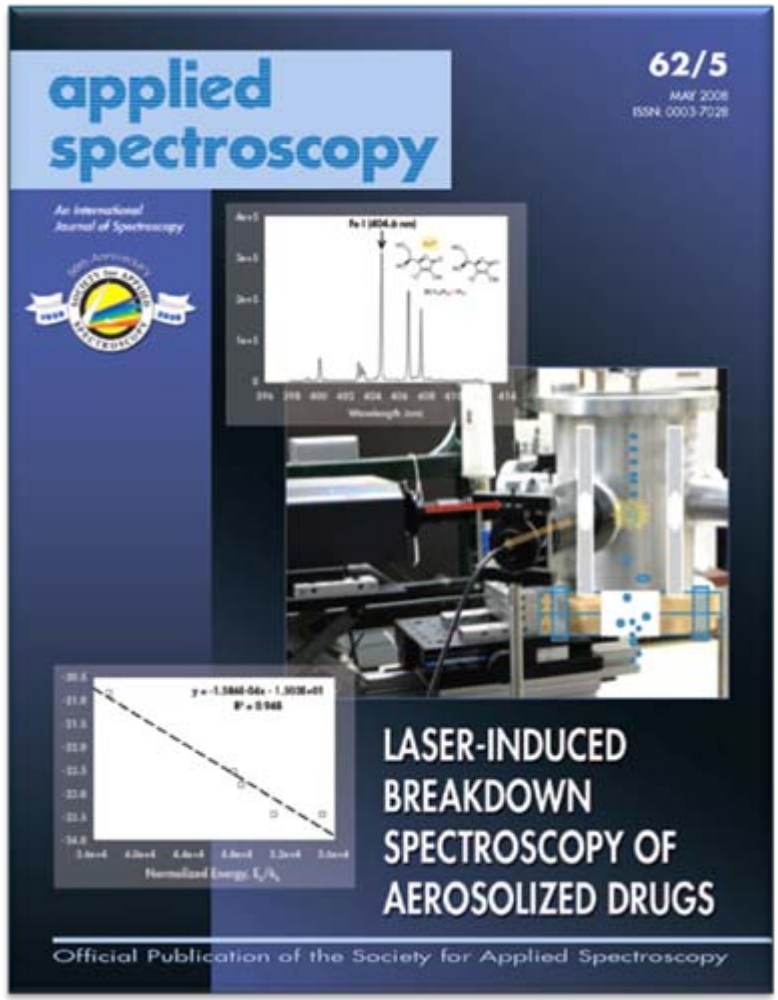
- Real-time analytical method for quantitative measurement of carbonaceous powders
- Technique offers real-time capability for positive identification of drug powders consisting of unique carbon and elemental fingerprints.
- Technique is anticipated to be amenable for on-line continuous monitoring of processes manufacturing materials other than drug powders.



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Cover Feature

Laser-induced breakdown spectroscopy was applied to aerosolized drugs and evaluated for the potential of real-time discrimination of different drugs in the Aerosol Research Laboratory at ORNL. Drug powders were aerosolized through an ejector-pump-powered dry powder dispenser and LIBS analyzed in the chamber enclosed; the elemental signature of each drug was identified by spectroscopic analysis of the optical emissions. The overlay schematic shows the interaction path of drug particles and the laser beam (red) and the emission light (brown) in relation to the location of the plasma. Displayed in the left upper panel is the high-resolution LIBS spectra for an ingredient (iron) embedded in a drug powder and in the left lower panel is the Boltzmann plot based on the LTE assumption for Fe atoms. For more information, please see the article "Characterization of Carbon-Containing Aerosolized Drugs Using Laser-Induced Breakdown Spectroscopy", by Dibyendu Mukherjee and Meng-Dawn Cheng.

Quantitative Characterization of Carbon Bearing Aerosolized Drugs using Laser-Induced Breakdown Spectroscopy, Dibyendu Mukherjee and Meng-Dawn Cheng, *Applied Spectrosc., 62: 554-562 (2008)*

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Ability to perform real-time on-line characterization of particulate materials produced through aerosol synthesis route offers possibilities for process optimization, quality assurance, and significantly improved production yield. Aerosolized drug delivery methods have increasingly become popular for pharmaceutical applications. This is mainly due to their ease of application and the more recent advancements incorporating nano-sized generation of particles that find deeper penetration routes and more efficient administration of the drug to specific target organs. Their effectiveness heavily relies on the uniformity of the chemical composition of these aerosolized drugs. Thus, it calls for a real-time on-line analytical tool that can accurately characterize the chemical constituents of the drug powder particles generated to ensure a stringent quality control. We present laser-induced breakdown spectroscopy (LIBS) ***for the first time*** as an efficient analytical tool to carry out on-line quantitative chemical characterization of aerosolized drugs. The results show LIBS can effectively estimate the quantitative ratios of carbon to various trace elements for each of these drugs thereby enabling on-line unique characterization of individual aerosolized drugs. The quantitative LIBS technique predicted the [C]/[Mg], [C]/[Fe] and [C]/[Ca] ratios as 4.02 +/- 0.76, 12.42 +/- 2.36 and 18.47 +/- 4.39 for each of the above aerosolized drugs respectively. Within error limits, these ratios are found in good agreement to the respective stoichiometric values of 4, 12 and 18 corresponding to the drugs above. The work demonstrated the utility and validity of LIBS in accurate and on-line identification of drug powders during real time manufacturing processes. It is likely the quantitative LIBS technique can be applied also to other particle manufacturing processes.

Quantitative Characterization of Carbon Bearing Aerosolized Drugs using Laser-Induced Breakdown Spectroscopy, Dibyendu Mukherjee and Meng-Dawn Cheng, *Applied Spectrosc., 62: 554-562 (2008)*

Also see - Dibyendu Mukherjee and Meng-Dawn Cheng, J. Anal. Atomic Spectrosc., 23: 119-128, 2008