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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : JURNAL ILMIAH

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Jumlah Penulis Status Pengusul Identitas	:	6 orang Penulis pertama/ ~~Penulis ke -~~ / ~~Penulis Korespondesi~~ **
Jurnal Ilmiah	:	a. Nama Jurnal : Journal of Applied Spectroscopy b. Nomor ISSN : 00219037, 15738647 c. Volume, Nomor, Bulan, Tahun : Vol. 86, No. 1, Maret 2019 d. Penerbit : Springer US e. DOI artikel (jika ada) : 10.1007/s10812-019-00797-2 f. Alamat web jurnal : https://link.springer.com/article/10.1007/s10812-019-00797-2 g. Terindeks di Scimagojr/Scopus ~~atau di….~~**
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Dr. Eng. Eko Hidayanto, S.Si., M.Si.
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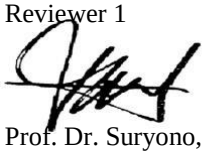

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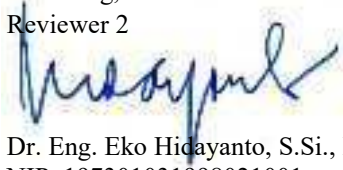

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Laser Plasma Spectroscopy Using a Pulsed CO_2 Laser for the Analysis of Carbon in Soil

Khumaeni A.[a], Budi W.S.[a], Wardaya A.Y.[a], Idris N.[b], Kurniawan K.H.[c], Kagawa K.[d]

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Abstract

Analysis of carbon (C) in soil has been successfully made by laser plasma spectroscopy using a pulsed carbon dioxide (CO_2) laser. Fine particles of soil sample were attached on a surface of the metal subtarget by adding a small amount of moisture; the metal was used to initiate the gas plasma. Experimentally, a pulsed laser was focused on the subtarget to induce a luminous plasma. The particles were vaporized and entered the plasma region. Dissociation and excitation happened in the high-temperature plasma region. The result certified that an analysis of C in soil can be demonstrated. A further measurement revealed that a calibration curve of C was successfully carried out. The limit of detection of C in the soil was around 23 mg/kg. © 2019, Springer Science+Business Media, LLC, part of Springer Nature.

Author keywords

carbon analysis; laser-induced breakdown spectroscopy; laser-induced plasma spectroscopy; soil sample

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Authors (first, second and last of 4)

DOI 10.1007/s10812-019-00777-6
Journal of Applied Spectroscopy, Vol. 86, No. 1, March, 2019 (Russian Original Vol. 86, No. 1, January–February, 2019)

STRUCTURES AND FLUORESCENCE SPECTRA OF MEROCYANINE DYES IN POLYMER FILMS

A. V. Kulinich and A. A. Ishchenko*

UDC 535.34;535.372

Absorption and fluorescence spectra of positive and negative solvatochromic merocyanine dyes of the same structural type in polymer films of various polarities, e.g., polystyrene, poly(vinyl butyral), and poly-N-epoxypropylcarbazole, are studied. Negative solvatochromic merocyanines are more prone to aggregate than positive solvatochromic ones. Quantum-chemical DFT calculations explain this by the larger dipole moments of the former. Merocyanine aggregates have a sandwich structure that causes fluorescence quenching. Aggregation occurs at higher dye concentrations in the more polar polymers. The studied merocyanines exhibit noticeable solvatochromism in the polymers, like in solutions. Polyene–polymethine transformations in the merocyanines are the most important factor determining their ability to fluoresce in the polymers, despite the fact that the fluorescence intensity of the merocyanines increases on going from solutions to polymer matrices.

Keywords: *merocyanine, polymer, solvatochromism, aggregation, absorption spectra, fluorescence.*

Introduction. Polymer matrices colored by functional dyes are widely used as recording and information-storage media [1–3], passive Q-switches [4], active laser media [5, 6], and solar cell elements (both photovoltaic media themselves and luminescent solar concentrators) [7, 8]. The advantages of colored polymer matrices over liquid dye solutions are the simple manipulations, increased dye stability [because of decreased oxygen diffusion; transfer of the excess of vibrational energy from dye molecules to polymer, which is especially effective for chemically bound (grafted) dyes; suppression of photoisomerization in viscous media], and the ability to work under extreme conditions (vacuum, low temperatures).

The properties of merocyanine dyes in polymer media are practically unstudied. This issue is especially important because their electronic structures and; therefore, their photophysical properties depend directly on not only structural factors such as the polymethine chain length and donor–acceptor properties of terminal groups but also the medium properties [9]. The goal of the present work was to investigate the effects of merocyanine structures on their spectral and luminescent properties in polymer films.

Merocyanines possess positive, reverse, or negative solvatochromism depending on the chemical structure [9]. Their electronic structures can vary over broad ranges from a nonpolar polyene (A1) to an ideal polymethine (A2) with equilibrated chain bond lengths and orders and the maximum alternation of π-charges along the chromophore and further to a dipolar polyene (A3) [10]

Structure A2 is noncanonical for valence bond theory and is identified because absorption and fluorescence bands shift to long wavelength and narrow as it is approached. Also, the fluorescence quantum yield increases because vibronic coupling in electronic transitions is diminished [9, 10].

The effects of the dye chemical structure and the medium on polyene–polymethine relaxation (position along the structure sequence A1–A2–A3) in merocyanines in ordinary solvents have been studied in detail. The present work used a series of structurally related dyes **1**–**12** in which the donor and acceptor strength of both terminal groups, the lengths of the polymethine chains, and the electronic structure changed regularly in order to carry out a similar study in polymer films:

*To whom correspondence should be addressed.

Institute of Organic Chemistry, National Academy of Sciences of Ukraine, 5 Murmanskaya Str., Kiev, 02660, Ukraine; email: al.al.ishchenko@gmail.com. Translated from Zhurnal Prikladnoi Spektroskopii, Vol. 86, No. 1, pp. 42–50, January–February, 2019. Original article submitted October 3, 2018.

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Journal of Applied Spectroscopy, Vol. 86, No. 1, March, 2019 (Russian Original Vol. 86, No. 1, January–February, 2019)

QUANTITATIVE ANALYSIS OF TRACE METALS IN ENGINE OIL USING INDIRECT ABLATION-LASER INDUCED BREAKDOWN SPECTROSCOPY

Junshan Xiu,[a*] Lili Dong,[b] Yunyan Liu,[a] and Jiyuan Li[a] UDC 533.9;543.42

In engine oil, the element composition and concentration changes as the engine operates. A rapid and effective detection of these changes, therefore, is needed to prevent accidents. Indirect ablation laser-induced breakdown spectroscopy (IA-LIBS) is a new technology introduced specially for oil samples. In this paper, 5 different oils are used for the analysis. The matrix effect on the calibration curves of analytical elements (Cu, Ti, Fe, and Ni) in these oils is investigated. The results show that the matrix effect is reasonably negligible under the conditions of our experiment. A generalized calibration curve can be established for analytical metals in different types of oils. We use the generalized calibration curves established to determine the concentrations of Cu, Ti, Fe, and Ni in mixed oils. The IA-LIBS results show that good agreement is obtained between the measured and known values.

Keywords: *indirect ablation LIBS, metals in engine oils, matrix effect, calibration curves.*

Introduction. Quantitative analysis of traces of metals in viscous liquids has a number of applications, for example, in detecting heavy metal pollution due to petroleum spills [1, 2], monitoring lubricating oil in engines [3], or screening cooking oils for the presence of hogwash oils [4]. Such metals as Fe, Cu, Ni, Ti, Cr, and Al can be added into engine oil by contamination or by wear in an engine during its operation. Therefore, the monitoring and determination of the metal content in engine oils is essential to identify the adverse consequences of contamination in engines and avoid losses [5]. However, the complexity of the matrix as well as high viscosity and high organic loads represent serious challenges for analytical chemistry to deal with engine oils.

In general, indirect analytical procedures involving elaborate sample preparation are regarded as established techniques for the determination of metals in liquids. The associated analytical techniques are atomic absorption spectrometry (AAS) [6, 7], inductively coupled plasma optical emission spectrometry (ICP-OES) [8], the spectrophotometric method [9], and mass spectrometry (ICP-MS) [10]. Good analytical performance can be obtained with a limit of detection (LOD) in the range from 10 to 100 ng/g (ppb in weight) for the dilution factor of the initial oil [11]. However, the above-mentioned indirect analytical methods exhibit disadvantages not only because of the highly complex and expensive equipment but also because of the required expertise and the time-consuming preparation of the sample. This increases the cost of the analysis and prevents *in situ* or online monitoring and measurement. Therefore, direct determination of metals in liquids is required.

Laser-induced breakdown spectroscopy (LIBS), as a rapid, sensitive, and multi-element analysis method, has attracted more and more attention in recent decades [12, 13]. Moreover, LIBS has been applied successfully to detect metals in engine oils [12–17]. Due to the complex process of ablation for liquids, a lower detection sensitivity is produced in this case as compared with the solid sample [13, 18]. In our previous work, we introduced an indirect ablation LIBS method for which a thin film of oil was coated on the polished surface of a pure aluminum target. The laser pulse was focused slightly under the target surface. It transmitted through the transparent thin liquid layer and induced hot metallic plasma, which, in turn, ablated the thin oil film and excited the emissions of metals in the coating oil film [19]. Indirect ablation LIBS for the detection of metals in engine oils is investigated, and lower LODs, ranging from several ppm to several hundred ppb, level are demonstrated for various metals [20].

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