Second-Order Advantage From Micelle Concentration Gradual Change–Visible Spectra Data

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Second-order calibration is used for second-order data. Such data is produced by instruments that give a matrix of responses for a single measured standard or unknown sample. This allows for determination of analyte of interest in the presence of uncalibrated sample constituents, a property known as the second-order advantage [1]. Malachite green has found extensive use all over the world in the fish farming industry as a fungicide, ectoparasiticide and disinfectant [2].This dye has also been used extensively for dyeing silk, wool, jute, leather and cotton [3].A similar situation is valid for crystal violet, which is used to control fungi and intestinal parasites in humans, as an antimicrobial agent on burn victims, to treat umbilical cords of infants, for the treatment of long-term vaginal candidosis, for various purposes in veterinary medicine, etc.[4]. It has been shown recently that some members of this group of compounds are linked to an increased risk of cancer and also act as liver tumor-enhancing agent. It was discovered that a second order spectra data matrix of malachite green and crystal violet produced from the micelle (of triton X-100 surfactant) concentration gradual change–visible absorption spectra can be expressed as the combination of two bilinear data matrices. Based on this discovery, a new method for the determination of malachite green and crystal violet in black systems using second order calibration algorithms has been developed. The second order calibration algorithms were based on the rank annihilation factor analysis (RAFA), un folded partial least-squares/residual bilinearisation (U-PLS/RBL)[5] and bilinear least squares/residual bilinearisation (BLLS/RBL)[6]. In the method described here, the concentration of the surfactant (sufficiently beyond the critical micelle concentration) was changed gradually and the absorption spectra of samples were recorded. Thus, the concentration of malachite green and crystal violet in black system could be determined from the spectra matrices using second order calibration algorithms. This method is simple, convenient and dependable. The method has been used to determine malachite green and crystal violet in simulated textile dye effluent, goldfish farming water and waste of nutrient broth-grown cell with satisfactory results.

References:

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