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Analytical Parameters for Amplitude-Modulated Multiplexed Flow Analysis

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Analytical conditions of amplitude-modulated multiplexed flow analysis, the basic concept of which was recently proposed by our group, are investigated for higher sample throughput rate. The performance of the improved system is evaluated by applying it to the determination of chloride ions. The flow rates of two sample solutions are independently varied in accordance with sinusoidal voltage signals, each having different frequency. The solutions are merged with a reagent solution and/or a diluent, while the total flow rate is held constant. Downstream, the analytical signal V_d is monitored with a spectrophotometer. The V_d shows a complicated profile resulting from amplitude modulated and multiplexed information on the two samples. The V_d can, however, be deconvoluted to the contribution of each sample through fast Fourier transform (FFT). The amplitudes of the separated wave components are closely related to the concentrations of the analytes in the samples. By moving the window for FFT analysis with time, a temporal profile of the amplitudes can be obtained in real-time. Analytical conditions such as modulation period and system configuration have been optimized using aqueous solutions of Malachite Green (MG). Adequate amplitudes are obtained at the period of as low as 5 s. At this period, the calibration curve for the MG concentration of $0 - 30$ μmol dm^{-3} has enough linearity ($r^2 = 0.999$) and the limit of detection (3.3σ) is 1.3 μmol dm^{-3}; the relative standard deviation of repeated measurements ($C_{MG} = 15$ μmol dm^{-3}, $n = 10$) is 2.4%. The developed system has been applied to the determination of chloride ions by a mercury(II) thiocyanate method. The system can adequately follow the changes in analyte concentration. The recoveries of

chloride ion spiked in real water samples (river and tap water) are satisfactory, around 100%.

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