Scientific Paper:

Cross-Reactive Metal Ion Sensor Array in a Microtiterplate Format

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Abstract:

A cross-reactive array in a micro titer plate (MTP) format is described that is based on a versatile and highly flexible scheme. It makes use of rather unspecific metal ions probes having almost identical fluorescence spectra, thus enabling (a) interrogation at identical analytical wavelengths, and (b) imaging of the probes contained in the wells of the MTP using a CCD camera and an array of blue-light-emitting diodes as a light source. The unselective response of the indicators in the presence of mixtures of five divalent cations generates a characteristic pattern that was analyzed by chemometric tools. The fluorescence intensity of the indicators was transferred into a timedependent parameter applying a scheme called dual lifetime referencing. In this method, the fluorescence decay profile of the indicator is referenced against the phosphorescence of an inert reference dye added to the system. The intrinsically referenced measurements also were performed using blue LEDs as light sources and a CCD camera without intensifiers as the detector. The best performance was observed if each well was excited by a single LED. The assembly allows the detection of dye concentrations in the nanomoles-per-liter range without amplification and the acquisition of 96 wells simultaneously. The pictures obtained form the basis for evaluation by pattern recognition algorithms. Support vector machines are capable of predicting the presence of significant concentrations of metal ions with high accuracy.