A VOC Dosimeter Based on a Colorimetric Sensor Array

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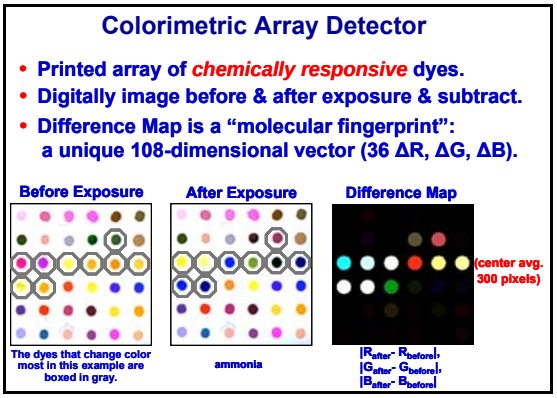
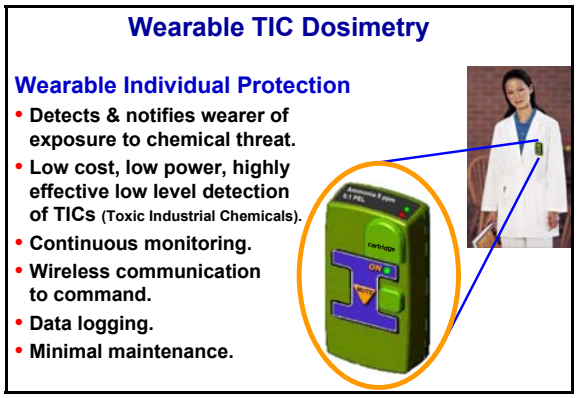
We have developed an entirely new class of lightweight chemical identification systems based on disposable colorimetric sensor arrays: essentially a digital, multidimensional extension of litmus paper. The design of the colorimetric sensor array is based on two fundamental requirements: (1) the chemo-responsive dye must contain a center to interact strongly with analytes; and (2) this interaction center must be strongly coupled to an intense chromophore. The first requirement implies that the interaction must not be simple physical adsorption, but rather must involve other, stronger chemical interactions. Chemoresponsive dyes are those dyes that change color, in either reflected or absorbed light, upon changes in their chemical environment. The consequent dye classes from these requirements are (1) Lewis acid/base dyes (metal ion containing dyes), (2) Brønsted acidic or basic dyes (pH indicators), and (3) dyes with large permanent dipoles (zwitterionic solvatochromic dyes). The coordination chemistry of metalloporphyrins is of special importance in the detection of many analytes that can act as Lewis bases. For the detection of volatile organic compounds (VOC), we have demonstrated high sensitivity (below PEL levels) for the detection of a wide range of toxic industrial chemicals (TICs), including amines, phosphines, thiols, both mineral and organic acids, and oxidants. Striking visual identifications of many TICs can be made even at ppb levels (comparable to GC-MS detection), for example to H_2S, NH_3, SO_2 and phosgene. In addition, highly selective discrimination of pure analytes and of complex mixtures has been demonstrated.





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