FROM SENSING TO MAKING SENSE

Paper On Demand: Inkjet Printing Of Task-specific Assays

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Colorimetric assays offer a low size, weight, power, cost (SWAP-C) and effective method for chemical threat detection and identification. Colorimetric assays may be machine-readable or human-readable depending on proposed application and response time required. Machine-readable assays offer high resolution capability over a wide range of chemicals, but the interpretation is left to the technological device and a longer wait time for decision making until the instrument analysis is completed. Human-readable assays provide a quicker response time, which is highly sought after by the warfighter, for decision making in the field. However, both methods are limited when a decision is based on subtle color changes; this may lead to misinterpretation and a false positive identification of a hazardous threat. Therefore, specific indicators with readily perceived color changes and specific analyte-targeting is highly desired. This in turn, also limits the design of the ticket and therefore improvement on the ticket design is also required.

Here we present a 'paper on demand' means that exploits the specificity in machine-read assays but for human-readable use. We have developed a system that uses inkjet-printable chemical indicators, a COTS inkjet printer, and custom software to allow any end user to print a mission-specific, ticket-type chemical identification assay at the point of need. Rather than including many indicators on a single assay or relying on high specificity at the indicator or material level, we use a response database to select the best subset of indicators to discriminate between a target and an interferent, both specified by the end user as a part of the interactive assay design process. We will present our methods for building our response database, our consideration of human perception of color in the ranking of indicator responses, and examples of how we demonstrated these concepts for both general chemicals, chemical simulants, and chemical warfare agents (CWAs). We believe this approach could find utility for first responders and other "burden-sensitive" users, and this technology may also serve as a platform for the deployment of more specific chemistries against threat agents as they are developed.