Novel Wearable Volatile Organic Compound Detection and Mitigation via Cumulative Solvatochromism and Dietary Modification

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1.1 billion individuals worldwide, particularly low-income workers in remote settings, are unknowingly exposed to dangerous gaseous concentrations of Volatile Organic Compounds (VOCs), according to a World Health Organization (WHO) estimate. In industrializing countries, chronic exposures at low concentrations are largely unregulated, but this exposure pattern has carcinogenic, organ-toxic, and endocrine-disrupting effects. Current VOC exposure sensors are expensive, heavy, and only measure ambient air in real-time—impractical. I developed a novel wearable patch that logs 14 days of cumulative VOC exposure in daily intervals using the solvatochromism of polydiacetylenes, coated with auto-degrading calcium alginate hydrogel. With one photograph of the patch, my machine-learning model evaluates the types, concentrations, and time periods of VOC exposure. I explored an accessible treatment to mitigate one such VOC's health harms: alleviating bone-degrading activity from chlorobenzene in a calvarial explant model via Vitamin D and sulforaphane, an isothiocyanate naturally found in broccoli, bok choy, and cabbage. My smartphone app packages exposure data to advise accessible treatments, aid medical diagnoses, and advocate to an Occupational Safety and Health Administration.

Awards Won:

First Award of $5,000