Fabrication of Napthalimide Point-of-Care (POC) Chemosensor Using InkJet Printing on Cellulose Paper for Determination of Uric Acid (UA) in Synthetic Urine and Aqueous Solution of Grain Samples, and Chromium Metal (Cr) in Drinking Water

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Background: Elevated serum uric acid (UA) is associated with obesity, hypertension, and metabolic syndrome. The goal of this research was to determine if a low-cost chemosensor-strip fabricated using an InkJet printer could be used for detection of UA without involving any sophisticated instrument or trained personnel. Detection of chromium metal (Cr) in aqueous solution is significant due to its high toxicity in drinking water for human consumption. Cr has been proven to nonspecifically bind to DNA and other cellular components resulting in inhibition of transcription and possibly DNA replication. Findings: A napthalimide-based fluorescent probe, developed to monitor the UA concentration in aqueous solution, exhibited high selectivity towards UA in synthetic urine. The fluorescence emission of the probe was enhanced upon binding to UA, which shows a unique concentration-dependent optical response towards UA. Additionally, the extent of insect infestation in stored grain samples was determined by measuring the UA content of their aqueous extracts. The paper chemosensor exhibited high selectivity towards Cr in drinking water. Here we used divinyl sulfone chemistry to immobilize napthalimide chemosensor covalently onto the hydroxyl groups of paper through nucleophilic addition. The use of an inkjet printer to form patterns of biomolecule on paper illustrate the adaptability of the functionalization technique developed here to pattern designs, with potential application in diagnostic test strip. Conclusions: These results suggest that the prepared test strip has the potential to detect UA and Cr in low sample volume, involves reduced production cost, and enables integration of customized test zone.

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