C34 Electrochemical Detection of Explosives and Their Metabolites in Fingerprint Sweat Using Molecularly-Imprinted Polyaniline Films

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After attending this presentation, attendees will understand the potential of molecularly imprinted electroactive polymers for the production of sensitive and specific biosensors for the detection of illicit excreted substances.

This presentation will impact the forensic science community by demonstrating the potential of molecularly imprinted electroactive polymers to be used for the electrochemical detection of trace amounts of explosive metabolites in the fingerprint sweat of suspected bomb makers. The capabilities of the methods presented herein may also be adapted to the detection of drugs and their metabolites. This presentation will also impact the field of biomedicine by potentially providing novel biosensors for the detection of specific biomarkers in sweat to diagnose disease.

The illegal production and transportation of explosives poses a constant threat to public safety and national security. Those individuals involved in the production and transportation processes are routinely exposed to these compounds, which are inevitably absorbed into the body, metabolized, and subsequently excreted through matrices, such as sweat. A method is proposed for the detection of these excreted explosives and their metabolites within the sweat of a fingerprint. Due to the minute volumes of sweat and the trace concentrations of parent compound and metabolites therein, this method requires both high specificity and sensitivity, while simultaneously being cost effective. Electrochemical devices are generally considered the most appropriate to satisfy those goals. The electroactive properties of polyaniline (PANi), as well as its ability to be molecularly imprinted when synthesized in the presence of a template molecule, make PANi an ideal polymer for this proof of principle. Subsequent removal of the template molecule leaves a PANi film with pores that are specific in size, shape, and polarity to the target molecule. Alternate methods of coating and imprinting of PANi nanofibers are being investigated as a means of imparting higher sensitivity to these films, owing to the greater surface-to-volume ratio offered by the nanofibers. Detection will be achieved by oxidizing/reducing the target molecules adsorbed on the imprinted PANi film, by use of cyclic voltammetry. The feasibility of this concept will be investigated by generating a PANi film imprinted with caffeine metabolites on a glass support in order to detect trace concentrations of such compounds in the sweat of a fingerprint. The hybridization of this technology with fingerprint identification technology would provide the capabilities of simultaneous collection of fingerprints and detection of illicit excreted substances within the sweat of the collected fingerprints.

Explosives, Fingerprints, Molecular Imprinting

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