
Wearable Electrochemical Biosensors for Detecting Host-Seeking Cues of *Anopheles gambiae* Mosquitoes

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The mosquito *Anopheles gambiae* utilizes olfaction to locate human hosts for malaria transmission, but the molecular mechanisms underlying this process remain poorly understood. Some identified odorant receptors include p-cresol and lactate in sweat. Here, we developed a wearable electrochemical biosensor on a paper substrate using the laser-scribed graphene (LSG) technique to detect lactate and p-cresol in human sweat. The electrochemical device consisted of two working electrodes, each modified with MXene/PtNP (a titanium carbide material with platinum nanoparticles), known for its excellent performance in detecting hydrogen peroxide (H₂O₂). The H₂O₂ is generated by enzymatic reactions facilitated by the modification of tyrosinase and lactate oxidase, enabling the specific and indirect detection of p-cresol and lactate, respectively. Under optimized lasing conditions (laser power of 9.5% and a scan rate of 40 mm s⁻¹) and functionalization, our wearable biosensor showed excellent electroanalytical performance, allowing the detection of p-cresol and lactate in concentrations ranging from 0.05x10⁻⁷ mol L⁻¹ to 50x10⁻⁶ mol L⁻¹ and 0.5x10⁻⁵ to 4.0x10⁻³ mol L⁻¹, respectively, using chronoamperometry. We achieved a limit of detection (LOD) of 0.01 × 10⁻⁷ mol L⁻¹ for p-cresol and 0.1 × 10⁻⁷ mol L⁻¹ for lactate. Importantly, the method showed adequate reproducibility (relative standard deviation (RSD) of 4.7% and 5.1% for p-cresol and lactate, respectively, n=10 biosensors). Additionally, the biocompatibility of the device was evaluated in the presence of fibroblast cell lines derived from mouse embryos, which were prepared in agar medium (10% m/v), mimicking the flexibility of human skin. This demonstrated that our device is safe for long-term skin application, real-time monitoring of the individual's skin.

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