Development of Low Cost Paper-Base Point-of-Care Platform for Quantitative Biomarker Analysis

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Point-of-care (POC) diagnostics serves to deliver rapid and robust results in resource poor settings; however, current tests have been hindered by qualitative “yes-or-no” results. The purpose of this research was to implement the principles of the common ELISA into a paper-based diagnostic platform to quantitatively analyze biomarkers. Time –course analysis with colored dye helped refine the original design and tune the sequential delivery of ELISA reagents on the cellulose platform. ELISA reagents, Peroxidase and Diaminobenzine, were preserved with novel sugar and metal compositions which were evaluated with optimized colorimetric assays to measure percent activity retained. A combination of Manganese/Trehalose on HrP retained 79.8% of activity over the 20 day trial. Likewise, 4% and 8% concentration of Trehalose retained 95.6% and 87.1% activity, respectively. The current device for the Immunoglobulin G protein has a limit of detection (L.O.D) of 10.6 ng/mL. As a proof to the versatility of this platform, the Bovine Serum Albumin or BSA has been implemented into the platform and preliminary results indicate a L.O.D of 11 ng/ml. Currently, the effects of long-term storage on the device are being evaluated. A software program to analyze the detection zone of the device has been created to reduce human error and simplify the analysis process by projecting biomarker concentration. From this initial research, the current diagnostic platform is cost effective (<$1.00 per device), sensitive, and serves as a proof-of-concept for the potential of the technology for quantitative biomarker analysis in resource poor settings.

Awards Won:

Second Award of $2,000