

Nanoelectronics Undergraduate Research Fellowship (NURF) 2010 Project Summary

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Project title: Paper Analytical Devices (PADs) used in Chemical Detection

Please write two paragraphs summarizing your NURF research. In the first paragraph, describe the problem / problem area. In the second paragraph, describe your activities and results. Please include one or two research images, with caption(s).

There are two main problems that were addressed in this research. The first issue addressed was the counterfeiting of antimalarial drugs. There are many different counterfeits of current antimalarial drugs that are being marketed as the real thing. Out in the field, there aren't effective methods for determining if a marketed drug is counterfeit. Using our PADs, we hoped to develop a simple microfluidic method for testing the validity of antimalarial drugs. The second issue addressed was the use of diethylcarbamazine (DEC) in Haiti to prevent filarial diseases. People in Haiti medicate the salt with DEC as a preventative measure. The methods currently used to test that the salt has the correct loading of DEC are expensive, time-consuming, and require a trained chemist. With our PADs, we tried to develop a simple, cost-effective way to determine if a sample of salt had the correct loading of DEC.

Paper analytical devices (PADs) were constructed by soaking substrates (Whatman No. 1 filter and chromatographic paper) in SU-8 photoresist and patterning channels for capillary fluid flow. The channels were fabricated via soft photolithography using a UV flood lamp and overhead transparency-based masks. We tested several techniques for developing the channels, controlling the wettability of the paper, and covalently attaching reagents to the cellulose in the paper channels. Analyses of DEC were performed by loading controlled quantities of reagents onto the PADs to carry out a semi-quantitative back-titration assay. Analyses of antimalarial drugs were performed using various indicators that test for functional groups and by-products of the antimalarial drugs (with focus on artesunate).



This is a picture of a blank PAD using Whatman No. 1 filter paper and SU-8 resist. The bright white pattern is hydrophilic and the translucent region is hydrophobic. The sample is placed in the central circle and channeled via capillary action throughout the PAD, so multiple tests can be run on one sample.



This is a picture of a starch iodine test that was run in one of the channels of a PAD. As seen in the picture, the positive test works in the hydrophilic channel of the PAD and is contained within the channel.

Paper Analytical Devices (PADs) used in Chemical Detection (Poster)