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| Title: | Latex Immunoagglutination Antibody Assay in a Microfluidic Device Using Static Light Scattering Detection |
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| Abstract: (Your abstract <u>must</u> use Normal style and <u>must</u> fit in this space. Your abstract should be no longer than 300 words. This space will 'expand' over 2 pages as you add text/diagrams into it.) | <p>Introduction:</p> <p>Although there is great interest, commercial microfluidic devices for immunoassays are still not readily available. Microfluidics can potentially improve assay performance by reducing the consumption of reagents, decreasing analysis time, increasing reliability and sensitivity through automation, and integrating multiple processes in a single device. Furthermore, particle-enhanced immunoassays can dramatically increase the surface area in the fluid volume and speed up incubation times by reducing diffusional distances.</p> <p>We have developed a microfluidic immunoassay device incorporating static light scattering (SLS) detection of latex microsphere agglutination. Our experiments demonstrate SLS detection with both blue LED and red laser light sources. Mouse IgG was used as the target biomolecule and plain and highly carboxylated polystyrene latex latex microspheres (0.51 μm) coated with antibodies to mouse IgG were used as probes. A miniature, portable, fiber optic spectrometer was used to measure forward light scattering intensity.</p> <p>Methods:</p> <p>The first goal of our study was to demonstrate proof of concept by showing that differing microsphere diameters and concentrations could be quantified on a simple glass slide with two pre-formed wells (800 μm deep) shown in Figure 1. Blue LED light was directed to the bottom of the slide and 45 degree scattering was detected with the miniature fiber optic spectrometer shown in Figure 2.</p> <p>Our second goal was to detect mouse IgG in a microfluidic channel by sensing microsphere agglutination using SLS from a blue LED as illustrated in Figure 3. Finally, we repeated the latex agglutination test using SLS from a red (He-Ne) laser (Figure 4) pointer costing less than \$10.</p> <p>Results:</p> <p>Figure 5 shows a plot of blue LED scattered intensity against volume fraction of polystyrene microspheres in a glass slide well. Light intensity increases linearly as the concentration of microspheres increases. Above 0.2% (w/v) the intensity then decreases according to the Flory-Huggins theory of polymer solutions. Figure 6 shows glass slide well data comparing SLS with spectrophotometer results. SLS displayed similar sensitivity to the spectrophotometer for detecting mouse IgG.</p> <p>SLS results in our microfluidic device are shown in Figure 7-8. Detection of mouse IgG using blue LED caused the intensity to double when agglutination occurred (Fig. 7). When a red laser (He-Ne) was used, the agglutination due to mouse IgG caused a 20% increase in scattered light intensity.</p> <p>Discussion:</p> <p>To the best of our knowledge, static light scattering has not previously been performed on a microfluidic platform. In addition, the small size and portability of this device offers a new, novel approach to conducting immunoassays.</p> <p>From this study, we can conclude that a portable microfluidic device for performing immunoassays is certainly feasible. Further, we have shown that either LED or laser light can be used to perform SLS with this platform, resulting in lower cost. This type of system could eventually be used for point-of-care testing of patients, as well as for detecting bioterrorist threats.</p> |

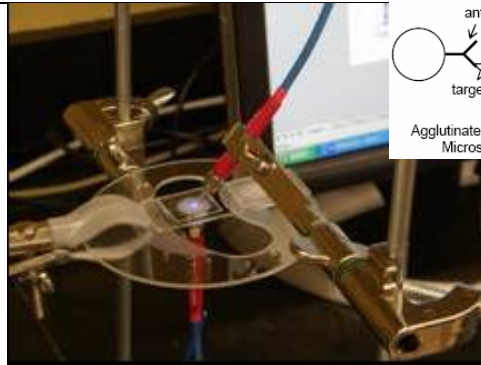


Figure 1. Glass slide with two wells (800 μm deep) containing microspheres.

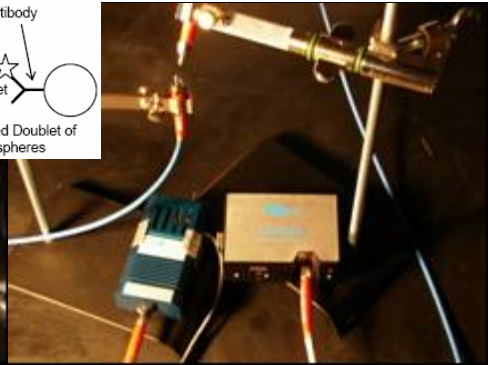


Figure 2. Blue LED light source (left) and fiber optic spectrometer (right).

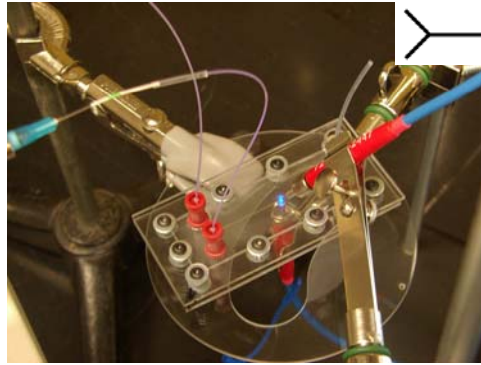


Figure 3. Microfluidic chamber and blue LED static light scattering at 45 degrees.

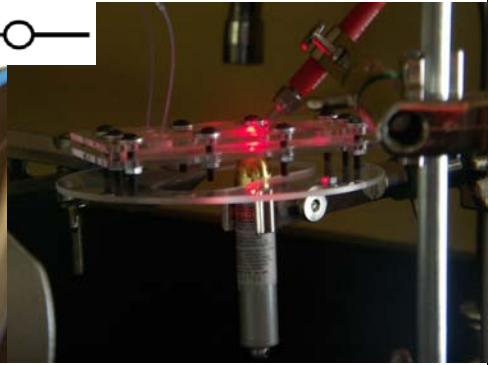


Figure 4. Battery powered He-Ne laser as light source for 45 degree SLS.

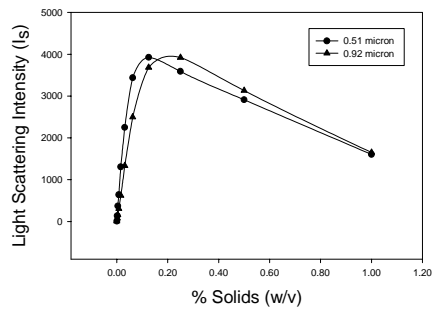


Figure 5. Microsphere size (.51 and .92 μm) effect on 45 degree SLS intensity.

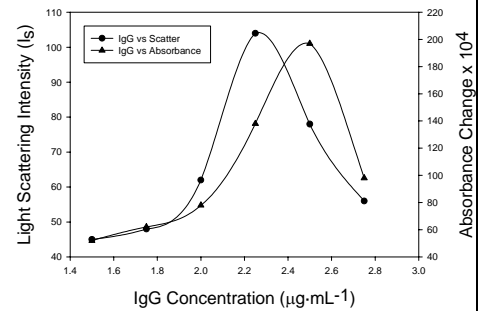


Figure 6. Comparison of agglutination data for spectrophotometer vs. SLS

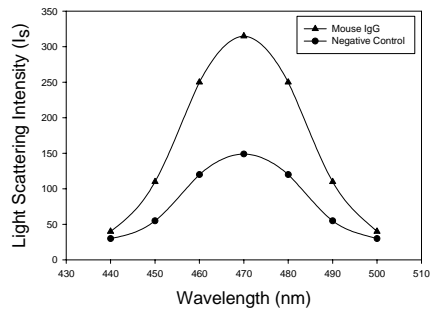


Figure 7. Detection of Mouse IgG using blue LED SLS

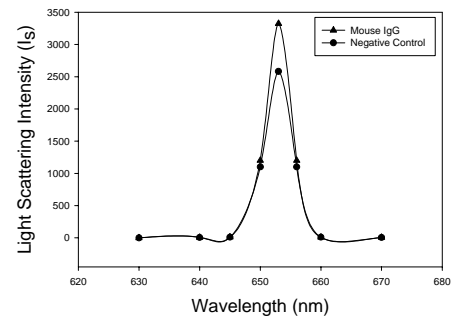


Figure 8. Detection of Mouse IgG using He-Ne laser SLS