A microfluidic-based hybrid SPR/molecular imaging biosensor for the multiplexed detection of food-borne pathogens.

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Abstract: It is important to screen our food supply for pathogen contaminations. Current methods to screen for bacterial contamination involve using costly reagents such as antibodies or PCR reagents or time-costly growth in cultures. There is need for portable, real-time, multiplex pathogen detection technology that can predict the safety of food where it is produced or distributed. Surface plasmon resonance (SPR) imaging is a sensitive, label-free method that can detect the binding of an analyte to a surface due to changes in refractive index that occur upon binding. It can be used for label-free detection of the presence of potential pathogens. Simultaneous fluorescence molecular imaging on the other side of the biochip can be used to ascertain pathogen status or functional state which may affect its potential danger to humans or animals. We are designing and testing hybrid microfluidic biochips to detect multiple pathogens using a combination of SPRI and fluorescence imaging. The device consists of an array of gold spots, each functionalized with a peptide targeting a specific pathogen. This peptide biosensor array is enclosed by a PDMS microfluidic flow chamber that delivers a magnetically concentrated sample to be tested. An SPR image is taken from the bottom of the biochip. Image analysis is used to quantify the amount of pathogen (both live and dead) bound to each spot. Since PDMS is very transmissive to visible light, an epi-fluorescence image is taken from the top of the biochip. Fluorescence imaging determines the live: dead ratio of each pathogen using an inexpensive SYTO 9®-Propidium Iodide assay. The volume of sample that the biochip can analyze is small, so possible pathogens are pre-concentrated using immunomagnetic separation. Functionalized magnetic particles are bound to pathogens present in the sample, and a magnet is used to separate them from the bulk fluid.

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