Detecting Microscopic Pathogens with Liquid Crystals

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Technology description

Many methods exist for detecting viral and bacterial pathogens in environmental and clinical samples, including conventional assays such as ELISA (enzyme-linked immunosorbent assay), as well as more recent advances such as surface plasmon reflectometry (SPR). Although these techniques work well for determining the presence of pathogens, they also require expensive, complex laboratory equipment and/or highly trained personnel. UW-Madison researchers have developed a liquid crystal-based device for simple, efficient and accurate detection of pathogenic microbes. The device consists of a micro-structured surface containing depressions that match the size and contours of a specific bacterial species or viral type. The surface is also treated to bind a specific pathogen of interest and to block non-specific binding.

When the substrate is exposed to a water or soil sample from the field, the pathogen, if present, attaches to the surface and occupies the depressions. Next, a liquid crystal surface is laid over the micro-structured surface. If the pathogen is present, the liquid crystal layer will respond by changing its color or brightness, allowing easy visual read-out by an observer. In the absence of the pathogen, the liquid crystal layer appears dark. The device surface may also be designed as an array, so that clinical or environmental samples can be probed for multiple pathogens simultaneously.

Application area

Pathogen detection

Advantages

Offers rapid and accurate pathogen detection, enabling informed decision-making at the earliest stages of a public health emergency
May be used in the field without the need for specialized laboratory equipment
Requires minimal training of personnel
Provides accurate results in much less time than conventional, serological tests, such as ELISA
Offers ability to screen for several pathogens at once

May be used to screen for a wide array of microscopic organisms, including bacteria such as E. coli and Mycobacterium tuberculosis , viruses such as West Nile and the foot and mouth disease virus, and other pathogens like cryptosporidium
Could potentially allow identification of target tissues and routes of entry for weaponized, recombinant microbes faster than genetic analyses
Could be used as a rapid screening technique prior to more complex pathogen detection analyses

Institution

Wisconsin Alumni Research Foundation

Inventors

Nicholas Abbott
Justin Skaife

联系我们

叶先生

电 话：021-65679356
手 机：13414935137
邮 箱：yeyingsheng@zf-ym.com