Multiple emulsion droplet design by Sichuan University

Scientists in China have developed a device that can control the production of multiple emulsion systems.

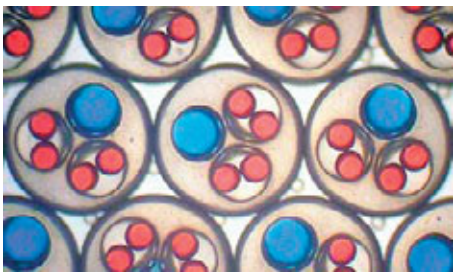
This system could be used to encapsulate incompatible drug ingredients and to design multi-compartment materials, they say.

Liang-Yin Chu at Sichuan University and colleagues have designed a microfluidic device capable of producing multi-compartment multiple emulsions.
The team tested their system using different coloured oil droplets in water. The device - a droplet maker, connector and liquid extractor - can be arranged in different combinations to generate different emulsions.

As the oil droplets move through the system, they merge in the main channel to form the multi-component emulsions.

The team now intends to explore the full potential of their device and promote its application in different areas.

esraa-chemist.blogspot.com



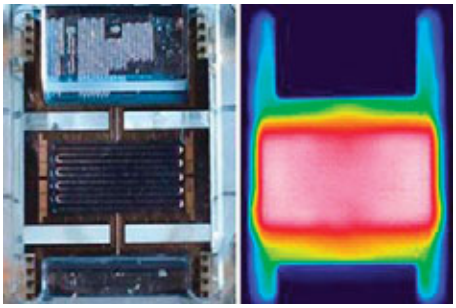
Optical micrographs of monodisperse sextuple (Courtesy of Sichuan University)

A*STAR microfluidic chip for quick on-site diagnosis of infectious diseases

The control of infectious diseases such as the 2009 H1N1 pandemic influenza hinges on handy analytical tools that can rapidly and accurately identify infected patients at the doctor's office or at an airport.

Linus Tzu-Hsiang Kao and co-workers at the A*STAR Institute of Microelectronics and the Genome Institute of Singapore have now developed a silicon-based microfluidic system that is able to sense and differentiate the H1N1 virus from other seasonal influenza strains in ultrasmall specimens.
The detection and characterization of viral strains is now routinely performed using an assay method called real-time reverse transcription polymerase chain reaction (RT-PCR). Kao's team, however, was able to integrate the PCR function into a compact two-module microfluidic chip using standard semiconductor technology.
Because untreated influenza samples usually contain minute amounts of viral RNA mixed with other nucleic acids and proteins, the researchers designed an 'on-chip' PCR module that amplifies target sequences for both H1N1 and seasonal viruses at the same time.

The key to their compact screening technology, however, is the silicon-nanowire sensing module used for virus identification. The nanowires in the module are modified with nucleic acid-containing polymers that specifically bind the target DNA, which results in a change in electrical resistance in proportion to the concentration of target DNA present in the sample.
The team fabricated the PCR module, which includes a reaction chamber connected to small aluminum heaters and temperature sensors through tiny channels, directly into a silicon chip using an etching technique. They then constructed the silicon nanowires by optical lithography and finally immobilized the nucleic acid-containing polymers.
Experiments revealed that the small size of the PCR chamber gave it a uniform temperature distribution (see image), providing an ideal environment for efficient RNA amplification. The PCR module also responded much faster to heating/cooling cycles than standard instruments because of the small sample volume—leading to quicker diagnoses.
The team is currently planning to improve the sample extraction module.



*Photograph of the PCR microfluidic chip (Courtesy of A*STAR).*

www.a-star.edu.sg

University of Illinois has developed a low-cost sensor for bacterial infections

Bacterial infections really stink. And that could be the key to a fast diagnosis.

Researchers have demonstrated a quick, simple method to identify infectious bacteria by smell using a low-cost array of printed pigments as a chemical sensor. Led by University of Illinois chemistry professor Ken Suslick, the team published its results in the Journal of the American Chemical Society.
While there has been some interest in using sophisticated spectroscopy or genetic methods for clinical diagnosis, Suslick's group focused on another distinctive characteristic: smell. Many experienced microbiologists can identify bacteria based on their aroma. Bacteria emit a complex mixture of chemicals as by-products of their metabolism. Each species of bacteria produces its own unique blend of gases, and even differing strains of the same species will have an aromatic "fingerprint."
Suslick previously developed an artificial "nose" that can detect and identify poisonous gases, toxins and explosives in the air.

The artificial nose is an array of 36 cross-reactive pigment dots that change color when they sense chemicals in the air. The researchers spread blood samples on Petri dishes of a standard growth gel, attached an array to the inside of the lid of each dish, then inverted the dishes onto an ordinary flatbed scanner. Every 30 minutes, they scanned the arrays and recorded the color changes in each dot. The pattern of color change over time is unique to each bacterium.

In only a few hours, the array not only confirms the presence of bacteria, but identifies a specific species and strain. It even can recognize antibiotic resistance – a key factor in treatment decisions.

In the paper, the researchers showed that they could identify 10 of the most common disease-causing bacteria, including the hard-to-kill hospital infection methicillin-resistant Staphylococcus aureus (MRSA), with 98.8 percent accuracy. However, Suslick believes the array could be used to diagnose a much wider variety of infections.

Given their broad sensitivity, the chemical-sensing arrays also could enable breath diagnosis for a number of conditions. Medical researchers at other institutions have already performed studies using Suslick's arrays to diagnose sinus infections and to screen for lung cancer.

Next, the team is working on integrating the arrays with vials of liquid growth medium, which is a faster culturing agent and more common in clinical practice than Petri dishes. They have also improved the pigments to be more stable, more sensitive and easier to print.

news.illinois.edu