Water Quality Testing in the Palm of Your Hand

UCF researchers have designed a reliable, easy to manufacture, and inexpensive microfluidic portable water sensor with disposable cartridges—capable of determining microbe growth, chlorine content, purity, or temperature.

Background
Microfluidics, or “lab-on-a-chip” technology, is experiencing explosive growth in the fields of chemistry, biology, electronics, and computers. These small devices work by allowing liquids and gases to flow through them, providing constant contact with the material of interest for continuous monitoring with a minimal sample volume. UCF researchers have taken this technology to the next level by developing a portable hand-held water monitor. This new device and cartridge system would provide simple water quality testing for environmental agencies, water treatment facilities, and any company selling water testing kits for home use.

Advantages
Using this technology, you can create an array of flexible devices for monitoring all the parameters of water quality, including chlorine content, temperature, or microbe levels via Biological Oxygen Demand (BOD). Previously, BOD measurements required five days to determine microbe levels by observing the depletion of dissolved oxygen. Now, due to its rapid feedback and portability, this device can be deployed on site for real-time water quality detection. Integrated with the device are an inexpensive, durable, chemically inert substrate and a temperature sensor, which takes into account all thermal effects on the chlorine concentration.

Technical Details
This technology uses inert polymers for the consistent packaging of an electrode layer, microbial layer, and microfluidic inlet and outlet ports. One embodiment is a disposable microsensor for continuous monitoring of free chlorine in water, while another is a disposable microbial sensor for rapid BOD measurement. For the chlorine sensor, gold, gold and silver/silver chloride comprise working, counter, and reference electrodes respectively. A transparent Cyclic Olefin Copolymer (COC) substrate is used for sensor fabrication by standard lithographic procedures. For the microbial sensor, a microbial strain is immobilized over one pair of sensor electrodes while the other is retained as a reference, where the BOD values of the sample can be measured in terms of the difference between the output signals. The sensor layer is attached to an injection molded passive microfluidic channel on top, used for a microfluidic package. This sensing circuitry is further connected to the display monitor showing the output data.

See related, “Interconnecting Microfluidic Package and Fabrication Method” UCF ID# 31566

Benefits
- Rapidly senses water impurities
- Inexpensive, portable handheld device
- Real-time on-site water testing
- Minimal water sample required

Applications
- Home water testing kits
- Water treatment facilities
- Environmental agencies

Tech Fields
Sensors, Microfluidics, Diagnostics

Keywords
water sensor, portable, water testing, biological oxygen demand, chlorine, microbes, microfluidics

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US Issued Patents
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