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Microfluidic Light-based Sensor for Chlorine in Water

Chlorine is a chemical utilized in the disinfection of drinking water. However, failure to regulate the amount of chlorine in the water results in the formation of harmful disinfection byproducts. Chlorine levels need to be monitored and maintained to ensure safety for consumers. The sensing devices currently in use are large, complex, and expensive to operate. Such conditions are cost prohibitive for many companies who need chlorine monitoring to have and maintain the necessary equipment.

With an increasing occurrence of various microbial water-borne pathogens that emerge with a lack of chlorine level monitoring and regulation, ability to sense chlorine levels is becoming increasingly important. Therefore, it is necessary to develop a chlorine sensor that is smaller, simpler, and more cost-effective so that chlorine monitoring can become a widespread practice to prevent water-borne pathogens from spreading.

Researchers at Arizona State University have developed a chlorine sensor that operates using principles of microfluidics and light. Microfluidics deals with the control and measurement of fluids that are constrained to a small scale.

In this sensor, chlorine is extracted as a gas from a water sample in a degassing chamber and then passed into a monitoring and detection chamber. In this chamber, LED light is passed through the gas. The sensor then measures the amount of light absorbed. Applying the knowledge that the amount of light absorbed by the gas sample is related to the number of gas molecules in a sample, precise measurement of the amount of chlorine gas present is possible. All of this is done with miniaturized equipment and without use of chemicals, providing increased accuracy at a higher efficiency.

Potential Applications

- Water systems
- Buildings
- Pools/spas
- Treated and reclaimed wastewater
- Bottling industries

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Benefits and Advantages

- Safety: Chemical-free sensing
- Accuracy: Measuring chlorine in gaseous phase eliminates sensor-fouling that occurs when measuring chlorine in aqueous phase
- Efficiency: Lower power consumption, less complex process for sensing than current devices
- Cost-Effective: No need to replace chemical reagents, reduced need for maintenance
- Size: Smaller than current sensor devices