An Economical Approach for Detecting Water Contamination at Homes - Preventing a Public Drinking Water Crisis

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Contamination in water poses a serious and mostly undetected threat. It is necessary for people to have an economical option to test the water they drink in their own homes. The goal of this research is to develop an economical device to detect contaminants like Lead, Fluoride etc that exceed EPA guidelines. Molecular bonds absorb energy and vibrate when exposed to infrared light. The vibrating bonds scatter light transmitted through them and cause frequency shift depending on the frequency of the transmitted light, also known as Raman Scattering. If various frequencies of light are passed through an excited molecule, each frequency of light will scatter differently. Therefore a molecular fingerprint can be created for a toxin by measuring and plotting the scattering of various frequencies of light. The molecular fingerprint may be used to detect the toxin in a water sample. Since Raman Scattering signals are fairly weak to detect with a low-cost light sensor, a technique called Surface-Enhanced Raman Scattering (SERS) was used to amplify these signals. Spot tests on filter paper were performed and a device was created that can capture the molecular fingerprint for a specific toxin. A linear model was established by studying the fingerprints of lead and fluoride toxins in the water. The device is paired with an iPhone application using Bluetooth to calculate either the lead or fluoride content from the linear model. This device successfully provided fairly accurate measurements for each sample, providing an affordable method to test the water supply in homes.

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