

Improvements in Field Methods for Arsenic Monitoring

Dan Kroll

Dan Kroll is an R&D Chemist for Hach Company based in Loveland, Colorado, a world leader in the provision of analytical solutions for the water and environmental industries. Dan has worked for Hach for 13 years. He has developed test methods for a number of different environmentally important parameters and holds a number of patents. He has BS degrees in Microbiology and Genetics and a Masters Degree in Water Resource Management and Environmental Engineering all from Iowa State University. Dan can be reached at 970-663-1377 ext. 2637 or e-mail at DKROLL@hach.com.

ABSTRACT

The USEPA maximum contaminant level (MCL) for arsenic has just been lowered from 50 µg/L to 10 µg/L. The quantification of trace amounts of arsenic in water samples has always been problematic. The series of new arsenic test kits described address many of the problems associated with other methods.

Hydrogen Sulfide is first oxidized to Sulfate to prevent interference, and the oxidizing environment is then neutralized. Sulfamic acid and powdered zinc react to create strong reducing conditions in which inorganic arsenic is reduced to arsine gas (AsH₃). The arsine gas then reacts with mercuric bromide impregnated test paper to form mixed arsenic/mercury halogenides (e.g. AsH₂HgBr). These compounds discolor the test strip depending upon the concentration of the arsenic in the sample. The color change is from white to yellow to tan to brown.

The method described has many advantages over previous methods. The chemical hazards encountered in older methods are reduced by substituting sulfamic acid for sulfuric acid in the arsine generation and supplying all reagents in unit dose form to minimize handling. The apparatus has also been redesigned to minimize operator exposure to arsine gas. The new method also results in increased sensitivity. Finally, sulfide, a common interference in arsenic testing, can be tolerated up to 5 ppm without the use of hazardous heavy metals. This kit and variations for higher range, increased sensitivity down to 1 ppb As and faster response time are described.

The methods described offer a safe, easy and accurate procedure for determining arsenic in the low µg/L levels without expensive apparatus or equipment. With slight modification they are versatile enough to detect all forms of arsenic encountered including organic compounds. They don't suffer from interference from sulfide like other common methods and have been shown to work on a variety of drinking and ground water samples.