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To: Ivars Jaunakais, Industrial Test Systems

From: Dr. Mark Sabo, Director, Catawba Analytical Research Laboratory

Subject: ITS Low Range Quick Arsenic Test Kit

Introduction

This report summarizes results from a verification study on the Industrial Test Systems, Inc. (ITS) Low Range **Quick™** Arsenic test kit (Part Number 481297). The work was coordinated at Catawba College in the Catawba Analytical Research Laboratory (CARL). The purpose of this study was to compare performance of the **Quick™** kit to a standard reference method.

Experimental

All standards and spiked samples were prepared at CARL using 18 MΩ de-ionized water. Industrial Test Systems provided the tap water samples, test kits, reagents, and the protocol for the study. Analysis of the standards (As III NIST traceable standard) and tap water samples with the **Quick™** arsenic kit was completed at CARL using the instructions and color chart found in the kit. These results were compared to the results obtained from a certified laboratory that used standard EPA Method 200.8, *Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)*. The list of standards, water samples, and the results of both methods are listed in Table 1. ICP-MS analysis was performed in duplicate on all standards and samples. Five replicate analyses using the **Quick™** kit were performed on the six standards used to complete the calibration curve, whereas duplicate analyses were performed using the **Quick™** kit on the 80 ppb As standard, the interference standard, and all three water samples.

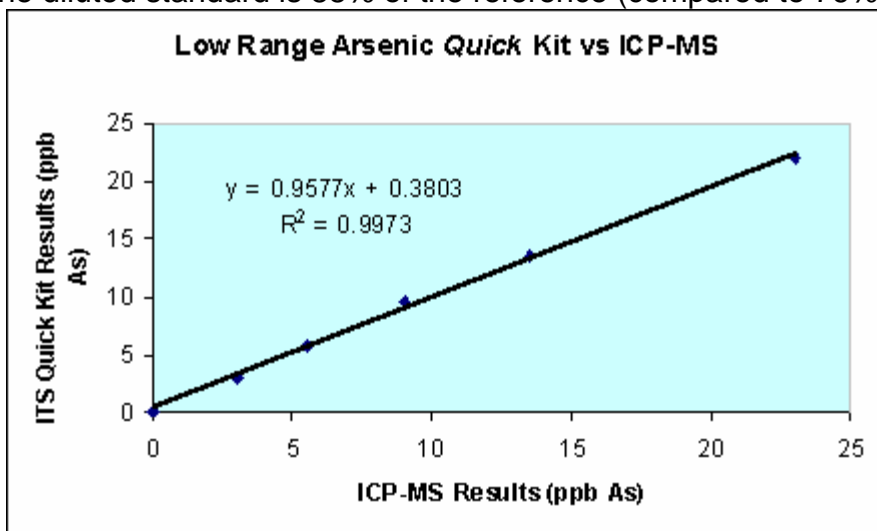
Sample Description	ICP-MS (ppb As)		Quick™ Kit (ppb As)	
0 ppb As standard	< 1	(<1, <1)	0	(0, 0, 0, 0, 0)
3 ppb As standard	3	(3, 3)	3	(3, 3, 3, 3, 3)
6 ppb As standard	5.5	(6, 5)	5.8	(5.5, 5.5, 6, 6, 6)
10 ppb As standard	9	(9, 9)	9.6	(9, 9, 10, 10, 10)
14 ppb As standard	13.5	(13, 14)	13.6	(13, 13, 14, 14, 14)
25 ppb As standard	23	(23, 23)	22	(22, 22, 22, 22, 22)
80 ppb As standard	79	(79, 79)	60	(60, 60)
80 ppb As standard (diluted 1:5 in kit)	NA	NA	70	(70, 70)
Interference sample, 10 ppb As and 1 ppb H ₂ S	11	(11, 11)	9.5	(9.5, 9.5)
Water Sample #1, Salisbury, NC	<1	(< 1, < 1)	0	(0, 0)
Water Sample #1 with 10 ppb As	11	(11, 11)	10	(10, 10)
Water Sample #2, Weaverville, NC	< 1	(<1, < 1)	0	(0, 0)
Water Sample #2 with 10 ppb As	9	(9, 9)	10	(10, 10)
Water Sample #3, Cookville, TN	< 1	(< 1, < 1)	0	(0, 0)
Water Sample #3 with 10 ppb As	10.5	(10, 11)	10	(10, 10)

The temperatures during all the Quick tests were between 22.0 °C and 24.0 °C.

Results

The certified lab reported a 3% relative standard deviation (RSD) for ICP-MS detection of arsenic at these levels. The RSD of the **Quick™** test kit was less than 5% in most cases, however, due to the incremental levels on the color chart one cannot talk about RSD in the typical sense. If a color on the test strip does not match up exactly with one on the color chart, the arsenic value is either higher or lower than the closest color on the chart and the reported value is left up to the analyst's interpretation. With that disclaimer, the reported values seemed easy to interpret with the Easy Read color chart provided in the kit.

A comparison of the **Quick™** method to the ICP-MS method can be seen in Figure 1. (The first six standards listed in Table 1 were used for this curve.) The data demonstrates a correlation coefficient of 0.997 vs. the reference method (ICP-MS) under the conditions and protocol used in this study. The minimum detection limit was not determined in this study, but the data demonstrates accuracy at 3 ppb As. A 10 ppb As-spiked deionized water sample with 1 ppm hydrogen sulfide recovered 86% vs. the reference. The 80 ppb As standard was analyzed by the **Quick™** test both undiluted and diluted (1 to 5) as per the **Quick™** instructions recommending dilution for samples above 30 ppb. The result of the diluted standard is 88% of the reference (compared to 76% of the undiluted).



Three different tap water samples were used in this study, one from Tennessee and two from North Carolina. The data in Table 1 indicate excellent As recovery when these water samples were spiked with 10 ppb As (>90% in all cases) and analyzed by the **Quick™** kit. There is also excellent agreement (> 90%) between the **Quick™** kit and the ICP-MS reference method for the three water samples analyzed.

Conclusions

The **Quick™** test kit provided reasonably accurate results on the types of tap water samples analyzed. The test method does not require that the operator have highly-specialized technical training. The test method and accuracy would be appropriate for quick field testing results; no complex, breakable apparatus is required. Furthermore, the method uses non-corrosive tartaric acid instead of corrosive hydrochloric acid, and no lead acetate is used, as used in other Marsh-type tests. (The strips do contain mercuric bromide, therefore care is needed in handling and disposing of the used test strips.)