USING A BATCH, SPECTREX, PARTICLE COUNTER AND PARTICLE STANDARDS TO MONITOR AND CONTROL IN-LINE, MET ONE, PARTICLE COUNTERS FOR CALIBRATION PURPOSES

Abstract
David Eugene Kimbrough, Water Quality & Laboratory Supervisor
Lo Labisi, Water Quality Scientist II

Introduction

The use of in-line particle counters to measure surface water filtration efficiency has grown increasingly wide-spread, driven in part by concerns about public risks associated with the cysts of water borne protozoan parasites, Cryptosporidium sp. and Glardia lamblia in particular. The cysts of these parasites are of well characterized sizes, 2-4 µm for Cryptosporidium and 5-15 µm for Glardia[1]. Since concentrations of particle in this size range do not correlate with turbidity measurements, turbidity removal efficiencies by filtration probably do correlate with particle removal. The Federal Surface Water Treatment Rule requires a 3-Log (99.9%) removal efficiency for particles of these sizes[2]. Over the last several years manufacturers have been adapting flow through or in-line and discrete or batch particle counters to potable water treatment needs, in particular setting up counting windows from 2 - 15 µm[3]. One of the concerns that has emerged as this technology has been purchased (at substantial prices) by more potable water agencies is the fact that field calibrations are generally not recommended and calibration checks in the field are extremely difficult. Particle standards in water are expensive, difficult to work with, can only be used once, and may not be a very effective diagnostic tool. There is a general perception that existing technology gives poor accuracy and inter-instrument precision. Given the important regulatory, public health, and financial implications, it is important that when these instruments are used, their results have some meaning. Various strategies have been proposed to deal with this problem.

The Castaic Lake Water Agency (CLWA) purchased six Met One in-line particle counters for each filter of its Rio Vista Water Treatment Plant (RVTP) as well as a batch particle counter from Spectrex. The individual filter effluents were monitored using the in-line particle counters and the raw water, clarified water, and combined filter effluent were monitored using the batch particle counter. In order to determine if the batch counter could be used as a master counter, two series of experiments were conducted. In the first series, the in-line and batch counters were compared directly under several different conditions to see how they compared in terms of total counts, distribution of counts, and over time. In the second series, a number of different particle standards were used to assess the accuracy of the batch counter in terms of total counts and the distribution of counts.

The goal of these experiments was to use the batch counter as a master counter to perform calibration checks on the in-line counters. If it could be shown that the batch counter can obtain accurate and reproducible results based on particle standards and that when the in-line counters

were out of calibration or otherwise not functioning properly, the batch counter could be used to identify the existence of the problem and assess its nature.

Conclusions and Recommendations

The working hypothesis of this study was that the Spectrex batch particle counter could accurately measure various artificial particle standards, was partially supported by the results. The Spectrex was very good at calculating total counts for the polystyrene spheres in water but did a mediocre job of describing the distribution of particles in the mono-dispersed population. If performed much better at describing the distribution of particles in the poly-dispersed standards.The Spectrex batch counter results can be traced back to several third party standards, both in terms of counts and distribution.
In this study it was clear that the Spectrex batch light scattering static counter can closely match the results obtained by the Met One flow through light obscuring dynamic counter despite the fact they are entirely different technologies, when the instruments are in proper calibration. The results are quite different in terms of variability as the Met One particle counters average six minute intervals (about 600 ml) while the Spectrex counts 10ml volumes four times a minute but when averaged over at least seven readings, the median results are often very similar. This ability to track the counts of Met One particle counters and to be traceable to third party standards allows the Spectrex batch counter to detect the calibration problems of in-line particle counters.

Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA, 91350-2173
805-297-1600 x223
dekclwa@sprynet.com

Literature Cited

1) Evaluation of Particle Counting as a Measure of Treatment Plant Performance, Hargesheimer E.E., Lewis C.M., Yentsch C.M., AWWA Research Foundation, 1992, Page 82.
2) Safe Drinking Water Act, Section 1412 (d), Federal Register June 29, 1989, Surface Water Treatment Rule.
3) Vasiliou J.G., Gilbert-Snyder P., Broadwell M., Duke S.D., "Use of Particle Size Standards for Validation of Particle Counters", Proceedings of the Water Quality Technology Conference, 1997, San Diego USA.
4) Sigma Stat ™ Statistical Software User's Manual, Jandel Scientific Software, 1994, San Raphael CA, USA