Performance Enhancements to TSI Water-based Condensation Particle Counters

J.H. Scheckman, S. Morell and F. Quant

TSI Incorporated, Shoreview, Minnesota, 55126, USA
Keywords: CPC, water-based CPC
Presenting author email: jacob.scheckman@tsi.com

Condensation particle technology has been a core aerosol measurement technique for many years (McMurry, 2000). Traditionally, butanol has been used as the "working fluid" in the condensation particle counter (CPC). More recently, water-based CPC's (WCPC) have been developed (Hering *et al.*, 2005), and used in nearly all CPC applications including standalone operations such as ambient monitoring as well as in multi-component systems such as SMPS.

Several enhancements to TSI's WCPC's have been implemented including flow system modifications, mechanical changes and firmware adjustments. These changes were made in order to improve long term reliability and ease of maintenance. Mitigation was added against rare flooding events as well as to enable complete flooding recoverability without permanent damage or requiring repair or recalibration. Mechanical changes to the inlet assembly allow for easier removal/replacement of the growth tube wick.

Small modifications to the WCPC engine resulted in a more consistent signal at high concentrations, and improved linearity as concentration approaches $1x10^6$ p/cm^3. (Model 3783 Environmental Particle Counter) Figure 1 shows an example comparison of the old design compared to the new design.

Additionally experiments are presented in which flooding was induced in properly functioning WCPC's with this new design. Figure 2 shows concentration data measured with a TSI Model 3783 WCPC sampling ambient laboratory aerosol while 10mL of water is injected (twice) directly into the inlet with a syringe. During the injection, the CPC concentration drops to zero as a steady jet of water flows through the optics. This is followed by a short spike in indicated concentration as the stream becomes intermittent, after which the concentration almost immediately recovers to its steady value. In additional experiments, we show that pulse height also returns to its steady-state value after recovery from an induced flooding event.

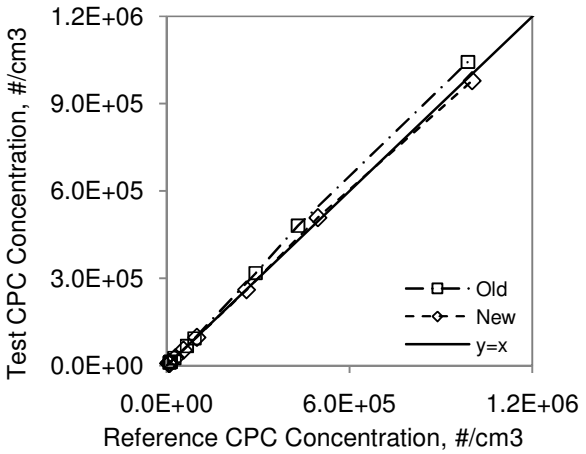

Figure 1. Comparison of linearity in Model 3783 Environmental Particle Counter with Old and New design.

Hering, S. V, Stolzenburg, M. R., Quant, F. R., O'Berreit, D. R., & Keady, P. B. (2005). *Aerosol Science and Technology*, 39(7), 659–672.

McMurry, P. H. (2000). *Aerosol Science and Technology*, 33(4), 297–322.