**Performance evaluation of a photometric particulate matter sampler at three sites in Uganda**

**Silver Onyango1, Beth Parks2**

**1. Mbarara University of Science and Technology, Mbarara, Uganda**

**2. Department of Physics and Astronomy, Colgate University, Hamilton, NY, USA**

**Introduction**

**Several human and environmental health problems are attributed to high concentrations of the inhalable and fine fractions of particulate matter (PM)** [1], [2]**. Information on PM in Africa and particularly in Uganda is scanty. The scarcity of information hampers determination of the human and environmental health risks, and mitigation strategies. One way to improve the quantity and quality of PM information is using less expensive monitoring techniques. An example is the TSI SidePak AM510 which is a portal and inexpensive photometric sampler capable of providing continuous data. However, the SidePak is factory calibrated to the respirable fraction of standard ISO 12103-1, A1 Test Dust (formerly Arizona Test Dust) which is usually different from dust from actual sites. It underestimates PM when compared with the reference gravimetric methods. Therefore, we aim at evaluating the performance of the TSI SidePak AM510 using samples collected for a long period from three sites (Rubindi, Mbarara, and Kyebando) in Uganda. Samples collection, preparation, weighing and analysis was done as described in** [3]**.**

**Results**

**Averaging over all samples, PM concentrations measured by the photometric method were 75% of concentrations measured by the gravimetric method. The mean PM10 mass concentration measured using the gravimetric and photometric methods were 141.8 ± 10 µg m-3 and 97.8 ± 6.2 µg m-3 respectively. The independent samples *t*-test showed that the difference between the two methods is not statistically significant. The differences in the mean PM10 mass concentration was 12.0 ± 10 µg m-3 and 35.7 and 50.7 µg m-3 in Mbarara, Rubindi, and Kyebando respectively. The underestimation of the mean PM10 mass concentration by the photometric sampler points to differences in the properties of dust (such as particle size distribution, refractive index, particle morphology and density) from different sites** [4]**. A correlation coefficient of 0.599 and *p*-value = 0.000 with an r-square value of 35.9% showed a moderate significant correlation between the photometric and gravimetric PM10 mass concentrations. Higher correlation have been reported for both single source indoor and multiple source outdoor environments than what is reported here** [5]**. However, such studies were performed at locations were the concentration of PM10 were much lower than is reported in this study. The result show that the SidePak can be used for monitoring PM10 mass concentration but may require recalibration for Ugandan dust.**

**3 References**

**[1] K. Mohapatra and S. K. Biswal, “Effect of particulate matter (PM) on plants, climate, ecosystem and human health,” *Int. J. Adv. Technol. Eng. Sci*, vol. 2, pp. 2348–7550, 2014.**

**[2] M. B. Rice *et al.*, “Long-term exposure to traffic emissions and fine particulate matter and lung function decline in the Framingham heart study,” *American journal of respiratory and critical care medicine*, vol. 191, no. 6, pp. 656–664, 2015.**

**[3] S. Onyango, B. Parks, S. Anguma, and Q. Meng, “Spatio-Temporal Variation in the Concentration of Inhalable Particulate Matter (PM10) in Uganda,” *International journal of environmental research and public health*, vol. 16, no. 10, p. 1752, 2019.**

**[4] J. Chow, J. Watson, K. Park, D. Lowenthal, N. F Robinson, and K. Magliano, *Comparison of Particle Light Scattering and Fine Particulate Matter Mass in Central California*, vol. 56. 2006. doi: 10.1080/10473289.2006.10464515.**

**[5] R.-T. Jiang, V. Acevedo-Bolton, K.-C. Cheng, N. Klepeis, W. Ott, and L. Hildemann, *Determination of response of real-time SidePak AM510 monitor to secondhand smoke, other common indoor aerosols, and outdoor aerosol*, vol. 13. 2011. doi: 10.1039/c0em00732c.**