WHY USE PHOTOMETERS FOR AIR FILTER TESTING?

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Photometers are widely used as detectors for air filters testing. You might ask why? Photometers don't count particles, they don't measure mass and they don't give size resolved (fractional) efficiency results. The reason has as much to do with the limitations of other techniques as it does with advantages of using photometers.

All counting techniques are limited by problems of measuring the high concentrations. Coincidence, i.e. multiple particles being detected at the same time, causes under-counting of particles and with optical particle counters it also results in sizing errors. When coincidence is ignored it is not unusual for negative efficiencies (penetrations over 100%) to be reported. To have a measurable concentration downstream of a filter, especially a high efficiency filter, a high concentration upstream of a filter is desirable. When measuring with a particle counter this often requires a diluter or a long sampling time downstream of the filter.

Photometers measure total light scatter and have a very large dynamic range. While photometers are very sensitive for low concentrations, also high concentration can be measured easily. A high concentration results in a larger upstream signal. Since penetration is downstream signal divided by upstream signal, having a large upstream signal allows for measurement of lower penetrations (and higher efficiencies). At the particle concentrations typically used when testing with photometers efficiencies up to five nines (99.999%) and beyond are possible. In addition, these tests can be performed fast and used in production inline testing.

Measuring high concentrations with photometers is also an advantage for loading tests. Loading a filter is important when trying to determine the usable life of a filter. Loading sometimes improves the filter efficiency but can also have the opposite effect. As this can be different for different types of particles (liquid droplets or solid particles), media material (woven or no-woven), and charge effects (e.g. electrostatic), the loading behavior must be studied and is typically part of certification criteria.

Air filter efficiency varies with particle size. Of particular interest is the efficiency in the region of the MPPS (most penetrating particle size). Filter testers that use photometers as detectors use polydisperse particle distributions generated by atomizers as their source of particles and these are in the general size range of the MPPS of typical air filters. This size range is also similar to outdoor ambient particle size distributions so testing in this size range gives a good indication of how filters will work in the real world.