GLOBAL AIR POLLUTANT DATABASE AND REAL-LIFE FILTER TEST RIG IN LABORATORY

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The development and selection of air filters are often based on laboratory filter tests, which mostly utilize a single blend of testing particles in a single environment condition to simplify the testing process. However, filters used in the field may not be exposed to the environment similar to the lab test conditions. The performance of air filters could depend on variations in pollutant compositions, working temperature and relative humidity. Therefore, it is necessary and important to develop a global air pollutant database which could provide pollutant compositions and climates data of different locations. Based on the database, air filter manufacturers could recommend the best fit filter product according to customers' locations or working environments; this is particularly important for intake air filters which experience ambient environment change while removing atmospheric aerosols from intake air. With the help of the global air pollutant database, customers could enjoy the advantages of latest air filter products, and filter manufactures could build reputations by providing customers with best products that fit the specific applications. At current stage, the air pollutant data and climate data of US and China major cities are collected from the USEPA and MEP of China, as well as published research papers. The air pollutant data includes the average pollutant concentration, speciation, distribution, and so forth. The climate data includes the temperatures and relative humidities of cities in four seasons. The global air pollutant database could be programmed as a handy online tool available to Center for Filtration Research member companies, who could retrieve the desired data easily.

To provide filter selection recommendations, it is crucial to understand the effect of the pollutant composition, temperature, relative humidity and so on to the air filter performance. Current filter test methods may not mimic the different working scenarios, including different pollutant composition, working temperature, and working relative humidities. Therefore, a test rig would help us understanding the effect of those factors if it could generate different types of the air pollutants and control the filter testing temperature and relative humidity. A test rig is designed and built in the Particle Technology Laboratory in the University of Minnesota. The test rig could generate dust, salt, oil, and soot particles, under controlled temperature from 0 C to 50 C, and relative humidity from 10% to 100% at most temperatures. The test rig could measure and record the pressure drop across two filter holders individually; the temperature and relative humidity is PID controlled with high stability. The test rig is controlled automatically by a home-built LabVIEW program which could achieve unattended filter test if desired. The schematic design of the test rig will be presented, as well as the sample filter test under different test conditions.