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Assessment and Control for Oil Aerosol

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Abstract : This study conducted an assessment of sampling result by using the new development rotation filtration device (RFD) filled with porous media filters integrating the method of cyclone centrifugal spins. The testing system established for the experiment used corn oil and potassium sodium tartrate tetrahydrate (PST) as challenge aerosols and were produced by using an Ultrasonic Atomizing Nozzle, a Syringe Pump, and a Collison nebulizer. The collection efficiency of RFD for oil aerosol was assessed by using an Aerodynamic Particle Sizer (APS) and a Fidas® Frog. The results of RFD for the liquid particles condition indicated the cutoff size was 1.65 μm and 1.02 μm for rotation of 0 rpm and 9000 rpm, respectively, under an 80 PPI (pores per inch□foam with a thickness of 80 mm, and sampling velocity of 13.5 cm/s. As the experiment increased the foam thickness of RFD, the cutoff size reduced from 1.62 μm to 1.02 μm. However, when increased the foam porosity of RFD, the cutoff size reduced from 1.26 μm to 0.96 μm. Moreover, as increased the sampling velocity of RFD, the cutoff size reduced from 1.02 μm to 0.76 μm. These discrepancies of above cutoff sizes of RFD all had statistical significance ($P < 0.05$). The cutoff size of RFD for three experimental conditions of generated liquid oil particles, solid PST particles or both liquid oil and solid PST particles was 1.03 μm, 1.02 μm, or 0.99 μm, respectively, under a 80 PPI foam with thickness of 80 mm, rotation of 9000 rpm, and sampling velocity of 13.5 cm/s. In addition, under the best condition of the experiment, two hours of sampling loading, the RFD had better collection efficiency for particle diameter greater than 0.45 μm, under a 94 PPI nickel mesh with a thickness of 68 mm, rotation of 9000 rpm, and sampling velocity of 108.3 cm/s. The experiment concluded that increased the thickness of porous media, face velocity, and porosity of porous media of RFD could increase the collection efficiency of porous media for sampling oil particles. Moreover, increased the rotation speed of RFD also increased the collection efficiency for sampling oil particles. Further investigation is required for those above operation parameters for RFD in this study in the future.

Keywords : oil aerosol, porous media filter, rotation, filtration
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