# Study on particle capture characteristics and numerical analysis for impaction sizer

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Design, testing and evaluation of an impaction sizer are very important for fine particles sampling in the atmosphere. Studies have pointed out that substrate coated with grease in the impaction sizer can maintain its capture particulate characteristics. However, the loaded particulate was accumulated on the grease substrate under long-time heavy loading conditions. Another foam impaction sizer has been applied to the study of fine particles sampling. The foam impaction sizer has the characteristics of reducing particulate rebound effect and of higher particulate loadings. However, its particulate capture efficiency curve does not follow the steep theoretical curve. The particle capture efficiencies of foam impaction sizer with larger porosity and thickness was found to be higher than those with smaller thickness and porosity.

In this study, the particle capture characteristics of an impaction sizer were studied experimentally first. Oleic acid particles were generated as liquid particles by utilizing an ultrasonic atomizing nozzle. An aerodynamic particle sizer was used to measure the aerosol number concentrations at the inlet and outlet of the foam impaction sizer installed in the lower section of the test chamber to determine the particle collection efficiency. Foam substrate was used as the collection substrates of impaction sizer with thicknesses of 3 mm and foam porosity of 100 ppi.

The flow field in the foam impaction sizer was then simulated by solving the Navier-Stokes equations in the cylindrical coordinate. The governing equation was discretized by means of the finite volume method. After obtaining the flow field, the particle equations of motion were solved numerically to obtained particle trajectories in the foam impaction sizer.

Fig. 1 shows the particle capture efficiencies of foam impaction sizer with jet diameter of 0.72 cm at the flow rate of 15 LPM as the rate of jet diameter to distance between jet and collection substrate equals 1. The particle capture efficiencies of foam impaction sizer increase as the square root of Stokes number increased. Results show that the particle capture efficiencies of foam impaction sizer for solid particles are similar with those for liquid particles. It indicates that particle bounce is insignificant for the foam impaction sizer as the particle loading in light condition. This study will perform the numerical calculations of the particle capture efficiencies for a novel foam impaction sizer. This study will also evaluate experimentally the particle capture efficiencies of the novel foam impaction sizer for different conditions.

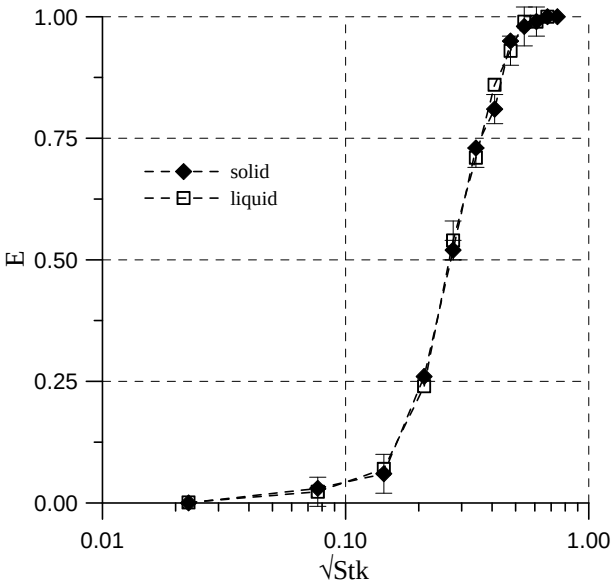


Fig. 1 Particle capture efficiency of foam impaction sizer.