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In-flight monitoring of particle deposition in the environmental control systems of commercial airliners in China

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Highlights

- Investigation of the particle deposition for different sizes in the environmental control systems of the commercial airliners.
- Particle mass concentration and particle size distribution were measured in 64 flights and compared to the outside particle level.
- The PM_{2.5} deposition rate in the ECSs of the older airplanes was higher than that in the newer ones.

ABSTRACT

Severe air pollution and low on-time performance of commercial flights in China could increase particle deposition in the environmental control systems (ECSs) of commercial airliners. The particles deposited in the ECSs could negatively affect the performance of the airplanes. In addition, particles that penetrate into the aircraft cabin could adversely impact the health of passengers and crew members. This investigation conducted simultaneous measurements of particle mass concentration and size distribution inside and outside the cabin during 64 commercial flights of Boeing 737 and Airbus 320 aircraft departing from or arriving at Tianjin Airport in China. The results showed that the PM_{2.5} mass concentration deposition in the ECSs of these airplanes ranged from 50% to 90%, which was much higher than that measured in an airplane with a ground air-conditioning unit. The average deposition rates of particles with diameters of 0.5–1 μm, 1–2 μm, 2–5 μm, 5–10 μm, and > 10 μm were 89 ± 8%, 85 ± 13%, 80 ± 13%, 73 ± 15%, and 80 ± 14%, respectively. The in-flight measurement results indicated that the particle concentration in the breathing zone was higher than that in the air-supply zone, which implies a significant contribution by particles in the interior of the cabin. Such particles come from human emissions or particle resuspension from interior surfaces.

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