On-board study of nano- and micrometer-particle characteristics of a running electric train

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Currently, the high concentration of particles in the enclosed environment such as railway tunnels and subway stations raised worries among researchers dealing with air quality (Abbasi *et al*, 2012, 2013). Although studying particle characteristics in rail traffic started in 1909, effective action has yet to be taken because of lack of relevant knowledge.

In this study for the first time an Alstom X-60 EMUs was instrumented by two sets of Optical Particle Sizers (OPS), TSI model 3330 and a NanoScan Scanning Mobility Particle Sizer (SMPS), TSI model 3910. The train was operated back-and-forth in a 86-km route between Älvjö and Uppsala stations in Swedish inter-city tracks over the course of 2 days.

Two sampling points were designated underneath of train compartment to represent both background and railway-source based particles (*e.g.* wheel-rail contact, braking materials, and concrete sleepers). Two other sampling points were designated inside the cabin compartment. All of sampling points were connected to OPS and Nanoscan SMPS (Fig. 1).

These characteristics were integrated with the train operational conditions from automatic train control (ATC) and Train control and management system (MSTC) data. According to this study, the dominant peaks of nano- and micrometer-particles were highly dependent on different environments such as tunnels, bridges, urban high-traffic and low-traffic area as well as different operational conditions such as acceleration and deceleration.

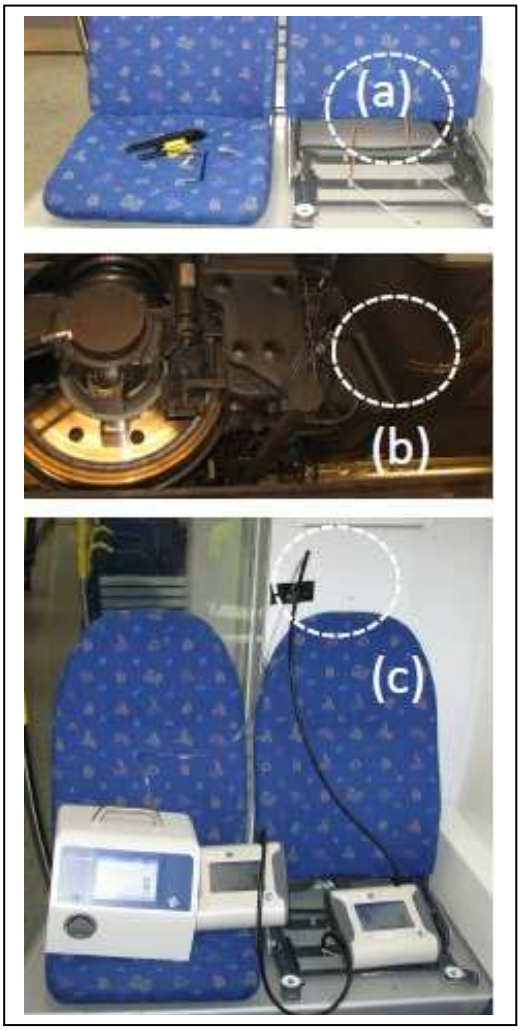

Fig 1. Sampling points set-up: (a) Head of copper tubes insides compartment; (b)Tail of copper tubes underneath of compartment and near bogie; (c) Sampling tubes inside compartment

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