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A Granular Bed for Use in a Nanoparticle Respiratory Deposition Sampler

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Calculation for collection efficiency of NRD impactor

The collection efficiency of the NRD impactor (*ηimp*) for salt particles by mobility equivalent diameter (*dm*) was shown in Fig. 3 of Cena et al. (2011), reprinted here as Fig. S1. We fit a line to these data using two empirical equations, Equations S1 and S2 shown below. The fitted line was added in red (bold line) to Fig. S1.



Fig. S1. Collection efficiency of NRD impactor (Cena et al., 2011). Particle diameter is mobility equivalent diameter.

 (S1)

 (S2)

where *dm* is in meters.

Equations S1 and S2 based on mobility diameter were generalized to express collection efficiency as a function of aerodynamic diameter in Equations S3 and S4. Equations S5 and S6 were used for converting diameters. A density (ρp) and shape factor (χ) of salt particles were assumed to be 2200 kg/m3 and 1.08, respectively.

 (S3)

 (S4)

 (S5)

 . (S6)

After converting the measured mobility diameter of test particles to aerodynamic diameter, Equations S3 and S4 were used to adjust measured collection efficiency of granular bed in the manuscript.

Collection efficiencies of the NRD impactor by mobility diameter for salt and metal particles are plotted in Fig. S2. The density of stainless steel and welding particles were assumed to be 3300 kg/m3 (Hewett et al., 1995). The shape factor of stainless steel and welding particles were assumed to be 1.4 (Hinds, 1999).



Figure S2. Collection efficiency of NRD impactor for salt, stainless steel and welding particles.

**REFERENCES**

Cena, L. G., Anthony, T. R., and Peters, T. M. (2011). A Personal Nanoparticle Respiratory Deposition (NRD) Sampler. *Environ. Sci. Technol.*, 45(15):6483–6490.

Hewett, P. (1995). The Particle Size Distribution, Density, and Specific Surface Area of Welding Fumes From SMAW and GMAW Mild and Stainless Steel Consumables. *Am. Ind. Hyg. Assoc. J.*, *56*(2):128-135.

Hinds, W. C. (1999). Aerosol Technology: Properties, Behavior, and Measurement of Airborne Particles, 2nd edn. John Wiley & Sons, Inc., New York, NY.