Investigations on *Legionella* containing aerosols: set-up of a model shower aerosol chamber

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Legionella spp. are ubiquitous in natural and artificial aquatic environments. Aerosolized and inhaled, these bacteria may cause Pontiac fever or Legionnaires' disease (Fields *et al.*, 2002). Thereby especially *L. pneumophila* Sg1 were found to be involved in infections. Showers are often discussed as one possible source for contaminated aerosols (Schoen and Ashbolt, 2011).

To minimize the risk of infection, legal limit values for the concentration of cultivable *Legionella* in tap water are applied (100 colony-forming units per 100 mL, TrinkwV, 2012). Unfortunately these limit values only restrict bacteria concentrations in the liquid, but do not include any information about the more significant concentrations in the aerosol. Up to now only theoretical predictions exist to estimate the correlation of liquid and aerosol *Legionella* concentrations in showers (Schoen and Ashbolt, 2011).

Subject of our research is to experimentally determine this correlation for shower aerosols. For this purpose a shower model (bioaerosol chamber) was constructed (see figure 1). It consists of a chamber (270 L) equipped with shower head and mannequin. Tap water is heated in a reservoir, artificially contaminated with defined concentrations of bacteria and transferred into the chamber. Several sensors are applied within the chamber to monitor temperature and relative humidity. To be able to work with aerosolized biosafety level II microorganisms, the shower model is encapsulated in a biosafety cabinet. As an additional safety feature bioaerosol chamber as well as biosafety cabinet are enclosed systems and harmful aerosols should only be present within the bioaerosol chamber.

First steps for system characterization are leakage tests for both bioaerosol chamber and biosafety cabinet. Therefore highly concentrated fluorescent dye solutions are applied to generate shower aerosols within the bioaerosol chamber. Subsequently swab tests and filter samples enable the detection of traces of shower aerosols within the biosafety cabinet or the laboratory atmosphere.

After the system is found to be free from leakage shower aerosols containing *Legionella* will be generated and sampled with a wetted-wall cyclone sampler (Langer *et al*, 2012). Thus the concentration of bacteria in the aerosol can be compared to the initial concentration in the water. In this way it can be investigated how the aerosolization process influences the *Legionella* aerosol concentration depending on various physical parameters. The quantification of *Legionella* will be done by culture, live/dead PCR and sandwich immunoassay microarray (Wunderlich *et al.*, 2016). The gained experimental results can be used to better understand how potentially infectious bioaerosols might be produced during showering.

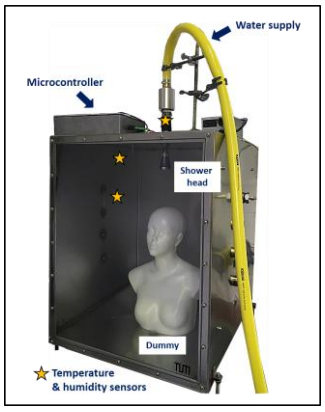

Figure 1. Setup of a bioaerosol chamber for the generation of shower aerosols.

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Drinking water ordinance, Germany (Trinkwasser-verordnung, TrinkwV 2012)

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