Summary of Predicted Deposition Rates for Aerosolization of Axhenol in a 10 m Duct

Report Prepared for Vionair, Inc., Montreal, CA

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Results and Discussion

The proposed experimental setup for the Desair disinfection unit will aerosolize a solution of water and axhenol or other compound in a 10 m long duct. This system was analyzed to determine the percent of salts that remain aerosolized after passing through the 10 m duct section. In order to perform this analysis it was necessary to first determine the droplet size distribution resulting from the aerosolization nozzle. Although the particle size distribution provided by the manufacturer did not extend down to the submicron range, the curve was estimated based on the normal probability distribution of submicron particles, which always forms a logarithmic bell curve. Figure 1 illustrates the curve fitting process. The blue dots show the data provided by the manufacturer, while the red lines indicate the fitted curve. The fitted curve is used in the subsequent analysis to determine both the settling and evaporation rates.

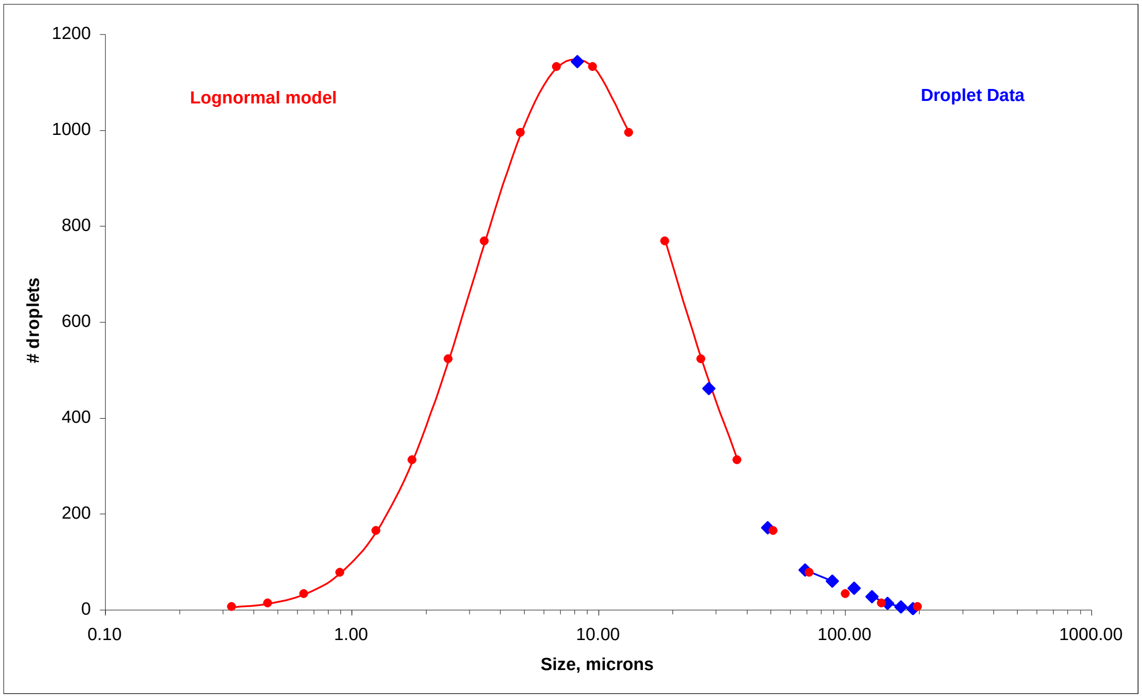

Figure 1: Curve fit (red line) of aerosol data (blue dots).

The injected aerosol is subject to simultaneous evaporation and settling over the 10 m length and both processes must be modeled in order to obtain an accurate prediction of the resulting final size distribution. The duct was modeled in twenty increments with half the increments in the first one meter, since this is where much of the evaporation occurs. In each incremental section, the evaporation and settling rates were computed based on the entering size distribution, after which the exiting size distribution was used as input for the next section.

Based on predictions of the combined settling and evaporation rates in the model system, it is estimated that approximately 4.07% of the total salts injected into the airstream will end up deposited on the duct. The remaining 96% of the salts will be exhausted at the duct outlet. Virtually all the water vapor evaporates in the 10 m duct, leaving only aerosolized salts concentrations airborne. Figure 2 below illustrates the particle size distribution before and after the aerosolization process. The 'before' curve (in blue) is the same as the curve in Figure 1. The combined process of evaporation and settling has the effect of shifting the particle size distribution lower since evaporation will reduce the droplet size and settling will remove the larger droplets. The remaining aerosol (the red curve in Figure 2) is virtually all salts.

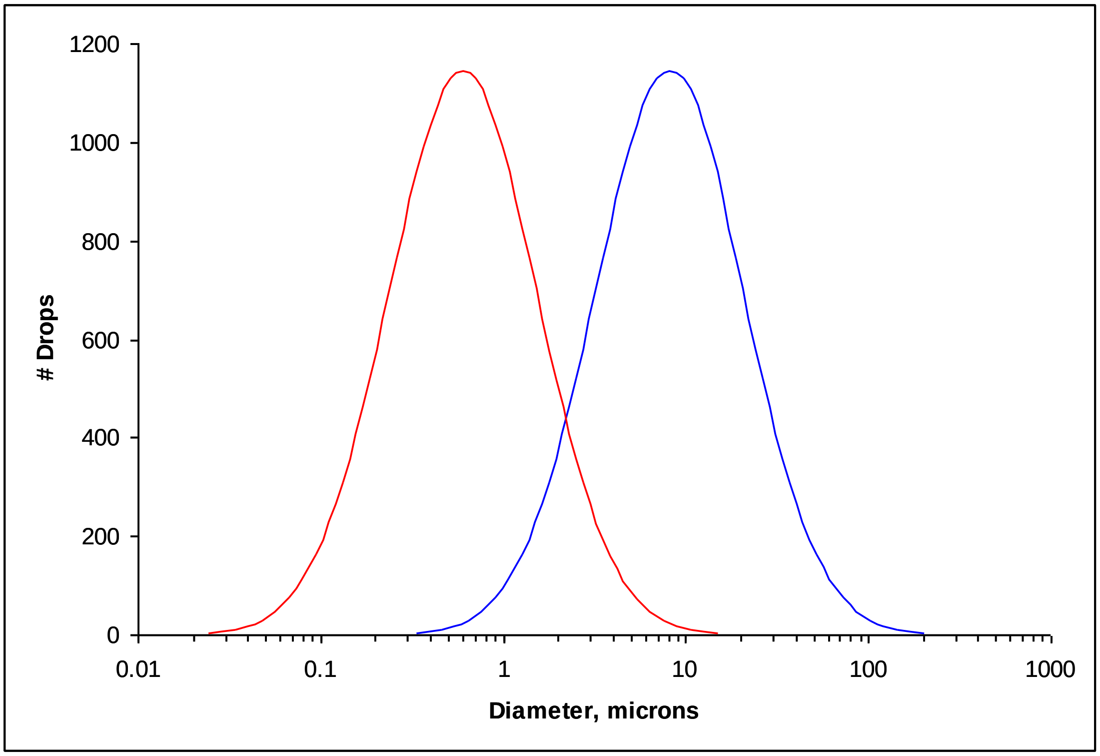

Figure 2: Size Distribution of Aerosol: Before vs. After 10 m of duct

The size distribution in Figure 2 represents a major change in total mass of aerosolized particles, showing approximately a two log (99%) reduction. Figure 2 illustrates the deposition rate along the length of the 10 m duct. Note that most of the settling and evaporation occur within the first 1 meter.

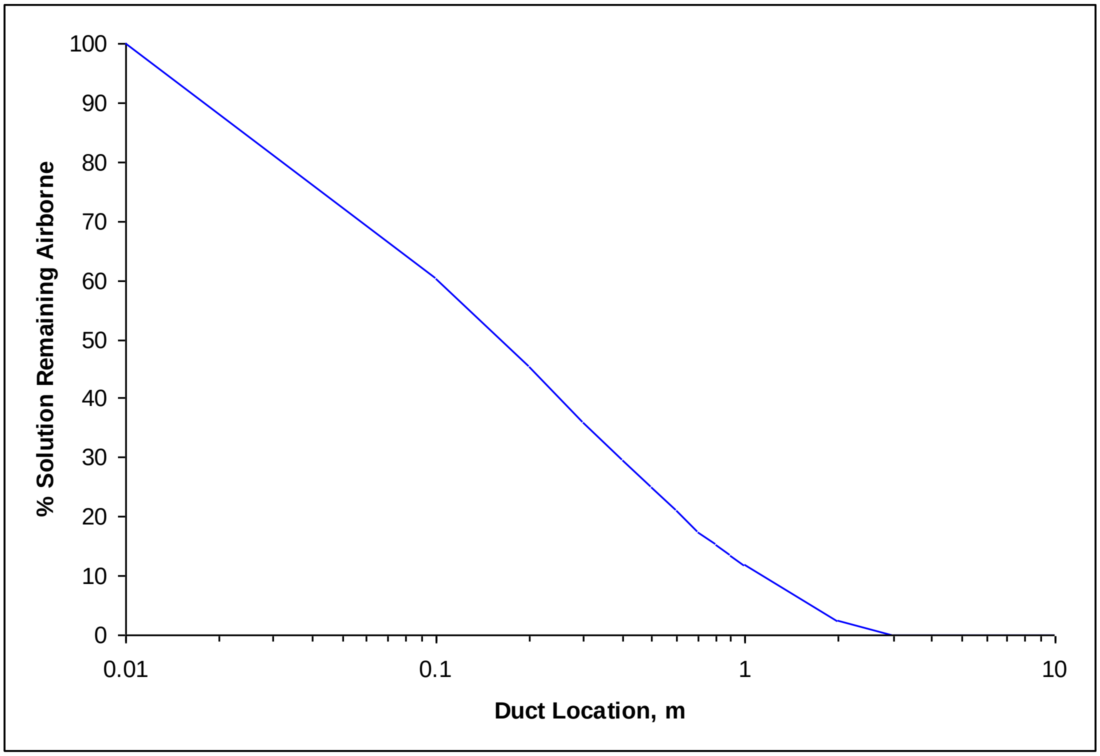

Figure 3: Deposition of aerosol along duct length

Based on these analytical results, it could be expected that almost all of the injected solution will evaporate or deposit on the duct walls, with less than 0.037% exiting the test apparatus. The exiting aerosol, however, is virtually all salts, and approximately 4.07% of the total salts will deposit on the duct, and the remaining 96% will exit the apparatus.

It should be noted, of course, that this represents the normal settling rate when there is no ionization present. The use of ionization should enhance and increase the deposition rate on the duct walls, although this is a problem that may not easily be solved analytically due to the dominance of the airflow and turbulence as a driving factor and their associated unpredictability – it is best determined empirically. That is, the final deposition rate will be established experimentally.