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SHORT-TERM EVAPORATION OF SEMI-VOLATILE N-ALKANE AEROSOL PARTICLES: EXPERIMENTAL AND COMPUTATIONAL APPROACH

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Abstract

The process of semi-volatile aerosol particle evaporation was studied with respect to both computational and experimental approaches. A Sinclair-La Mer type aerosol generator was used to produce monodisperse particles from four n-alkanes (tetradecane, hexadecane, octadecane, eicosane) while particle sizing and FID measurements were applied to quantify particle- and vapor mass and their subsequent phase distribution. Aerosol dilution and later stationary analyses in a flow tube at two time intervals enabled an experimental study on particle evaporation into a finite and constant volume. Experiments carried out for n-alkanes at 25°C showed that tetradecane particles evaporated almost completely within 3 seconds whereas eicosane particles remained nearly unchanged. A diffusion based model that accounts for the evaporation dynamic of variously concentrated particle populations was developed. Good agreement between experimental and computational results was found, with relative deviations being less than 20% for the majority of the experiments. The study has shown that evaporation of semi-volatile n-alkane aerosol particles can be successfully predicted using the diffusion based model.

Key words: evaporation, mass concentration, mixed phase aerosol, particle size distribution, semi-volatiles

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