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1 First direct measurements of the CCN properties of 2-methyltetrols and polyols

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2-methyltetrols and polyols have received a lot of attention in recent years. 2-methyltetrols have been found in aerosols in various regions are believed to be formed by the oxidation of isoprene. Polyols are produced by fungi and have been measured in large concentrations in aerosols. The main reason of interest of both 2-methyltetrols and polyols as efficient cloud condensation nuclei (CCN) is due to their high solubility.

This presentation will report for the first time the experimental determination of complete Köhler curves for 2-methyltetrols (2-methylerythritol and 2-methylthreitol), C3 to C6 polyols (glycerol, erythritol, arabitol, and mannitol), and for comparison their analogue di-acids (malonic acid, succinic acid and, adipic acid). The original Köhler equations were determined from osmolality and tensiometry measurements of the compounds both in water and salt solutions (sodium chloride and ammonium sulphate).

The results indicate that the polyols generally have similar CCN properties as the dicarboxylic acids. The critical supersaturation for aerosol particles with a 30 nm radius were: 2-methyltetrol; 0.68%, mannitol; 0.62%, arabitol; 0.60%, 2-methylerythritol; 0.57%, erythritol; 0.56%, glycerol; 0.53%, adipic acid; 0.52%, succinic acid; 0.49%, and malonic acid; 0.44%. Mixtures of salts had lower critical supersaturation than wa-

ter solutions, especially for the polyols. One exception was 2-methylerythritol, which interestingly was less efficient as CCN in salt solutions.

The CCN efficiency of the polyols is believed to result mostly from their large water affinity, enforcing the Raoult effect, while organic acids lower the Kelvin effect. The very large solubility of polyols compared to the di-acids mean that they could positive effect in the initial phase of the droplet growth while the di-acids cannot. 2-methyltetrols were found to have both a Kelvin and a Raoult effect.

In addition, these results establish for the first time that the 3-dimensional structure of molecules can have an effect on their CCN properties. The two isomers of the 2-methyltetrols have significantly different CCN properties that are also influenced oppositely in the presence of salts.