A new kind of substance for the rapid activation and heterogenous growth of nanoparticles in particle counters

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Aerosols containing nanoparticles below a certain size cannot be measured easily. A Condensation Particle Counter (CPC) is one of the most important measuring instruments used in aerosol science because it makes the particle counting process essentially size independent. The CPC operates by evaporating a working fluid through heating and cooling, causing it to condense onto the particles. This condensation process results in significant particle growth, allowing for detection through an optical measurement cell. The working fluid is a crucial component of any CPC instrument. Ideally, it should have low consumption and not be toxic or harmful to the environment. Previous research has shown that dimethylsulfoxide (DMSO) can be used as a working fluid in alcohol-based CPCs with only minor modifications (Weber et al., 2023). DMSO is a naturally occurring and sustainable substance that poses no hazards. The initial scientific characterization of DMSO as a new working fluid in alcohol-based CPCs was conducted.

In our experimental study, we used a differential mobility analyser (model M-DMA 55-U, Grimm Aerosol Technik, Ainring, Germany) to select monodisperse particle sizes. We also used an electrometer (model 5.705, Grimm Aerosol Technik) as a reference instrument for particle number concentration. The experimental set-up included various mass flow controllers to adjust the in-line pressure using a PID approach. The substance's behaviour as a working fluid in a CPC was characterised for operating pressures ranging from ambient pressure down to 200 hPa. Additionally, the counting efficiency and the D50 cut-off diameter were analysed in detail under different measurement conditions.

Additionally, we will introduce a new substance for the rapid activation and heterogeneous growth of nanoparticles that has not been previously used in particle counting instruments. This new substance introduces a new form of particle growth principle. We will confirm our new finding by conducting an initial analysis of its applicability and examining its characteristics, including the lower cut-off diameter and overall instrument response, which are similar to those of DMSO.

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