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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effect of organic compounds on nanoparticle formation in diluted diesel exhaust" *by* U. Mathis et al.

Anonymous Referee #2

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The paper presents the effect of particle formation by nucleation from gas phase by diluting diesel exhaust depending on the presence of 10 different organic compounds within the dilution air. Additional the influence of dilution air humidity was investigated. Interesting mechanistic effects in enhancing or suppressing nucleation particle formation from diesel exhaust are presented. However the paper exhibits some weaknesses stated in the comments below.

Comments :

1) Nucleation particle formation is very sensitive to experimental conditions and the authors have taken this already into account. However it would be rather useful to show how reproducible the formation of nucleation particles throughout the test series was. It needs to be shown that ageing effects of instrumentation or vehicle are not

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responsible for observed effects. E.g. soot mode maxima presented in figures 3, 6, 7, 8 and 9 vary between 1.0*10ˆ8 and 1.6*10ˆ8 cm-3 which is much larger than the uncertainty in dilution ratio given in table 3. Please explain! Data on sulphate content of particles would be very useful to show stable exhaust concentrations of this important nucleation precursor. The data points at 0% saturation ratio in figure 5 scatter from 0.02 to 0.25 for condition A, 0.2 to 0.63 at condition B and 2.2 to 3.6 at condition C, which already shows some instability occurring during these experiments. Data points at higher saturation ratios need to be addressed more carefully with respect to this scatter, especially if effects are weak in cases of toluene, aniline, acetone and MTBE. I.e. effects observed might be only test-to-test variation!

2) The introduction states very widely why nucleation particle formation might be important for ambient atmosphere, however the conclusions leave this point open. The observed effects need to be put in context with atmospheric conditions and if they would have implications for ambient air.

3) Experimental, second paragraph: 99% rel. Hum. at dilution point raises the question about the possible effects within the residence time volume due to cooling, e.g. increase in rel. humidity or condensation. Has the residence volume been kept at the respective sample temperature or how has this been accounted for with respect to data evaluation?

4) Results and discussions, chapter 3.2.2: The possible explanation for aniline effect given implies a removal process involving ionic reactions in gas phase, which are unlikely, since this typically requires a solvent (e.g. water). Further it is stated this would form particles in the size range of accumulation mode particles, which is also unlikely, because reactions of gas-phase compounds would form very small new particles that might grow and appear in the nucleation mode.

5) Results and discussions, chapter 3.2.5: The authors introduce the idea of a surface tension effect changed by different alcohols in conjunction with water solubility, water

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miscibility and concentrations (saturation ratios). This needs to be baked by solid data. I.e. it needs to be shown that the surface tension is lowered according to above parameters in the same order as nucleation is increased, otherwise the explanation should only be stated as 'possibly'.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 227, 2004.