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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of temperature on the molecular composition of ions and charged clusters during pure biogenic nucleation" *by* Carla Frege et al.

Anonymous Referee #2

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The manuscript describes laboratory experiments in the CERN CLOUD chamber. The authors investigate the molecular composition of positive and negative HOM clusters measured with APi-TOFs at three different temperatures (25°C, 5°C and -25°C). The authors discuss the cluster formation in the positive and negative ion mode, the average oxygen-to-carbon (O:C) ratios focusing on the influence of the changing temperature. They essentially conclude a decrease in the rate of autoxidation with decreasing temperature. The experimental findings are supported by quantum chemical calculations of the binding energies of representative neutral and charged clusters. In general, the paper is well written and presents an interesting topic that is well suited to be published in ACP. The molecular processes of new particle formation, especially if organic

molecules are also involved, are not well understood. Therefore, I suggest to publish the manuscript in ACP after considering the following comments.

Page 6, line 167: Impurities from alpha-pinene or chamber background ? Could that be signals from previous experiments (e.g. pinanediol ?)

Page 7, line 197: What does "under relatively dry conditions" mean ?

Page 10, line 257,258: The ion C20H32O13.NO3- is mentioned two times ?

Page 14, line 329: ". . . bands For a . . ." !?

Page: 14, Table 2: The O/C-ratios from the monomers to the dimers are increasing in the positive mode and decreasing in the negative mode. While the decrease could be a result of oxygen loss in the formation of the dimers (in this case covalently bonded dimers (e.g. condensation reactions !?)), the increase in the O/C-ratio is more difficult to explain. One possibility would be the preferred formation from monomers with a rather high O/C-ratio, similar what the authors use as explanation for the tetramer formation, however, I wonder if the authors also included the C10H14OH+ signal in their signal weighted average O/C calculation (looking at figure 4 it seems so). In this case the inclusion of the background signal is of course misleading and should be corrected.

Page 14, line 341: The authors often use the expression "cores". I suggest to use simply "compounds" or "molecules".

Page 14, line 345: Again, I have the impression that the authors refer to the background signals mentioned earlier (compounds containing 1 oxygen atom) !? The explanation given on the next page (main oxidation products) is definitely not satisfying (in other words: pinonaldehyde is C10H16O2 and pinonic acid C10H16O3 – a factor of 2-3 higher in oxygen than needed).

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