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## ***Interactive comment on “The effect of low solubility organic acids on the hygroscopicity of sodium halide aerosols” by L. Minambres et al.***

### **Anonymous Referee #3**

Received and published: 14 April 2014

The manuscript describes laboratory studies on the impact of organic acids coating on sodium halide compounds. The hygroscopicity of salts depends on its elemental composition and a type of coating acid. The deliquescence of salts is influenced by the organic acid in various ways, depending on the compound and type of the salt. Techniques used in the experiments allow for investigation of the impact of medium and long chained hydrocarbons on the aerosol. The study presents interesting findings and will be suitable for publication in ACP after addressing major and minor comments.

Major comments:

1. The background of the paper should be described more, especially impact of organics on the marine primary aerosol (POA) properties.

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2. Key facts about marine aerosol in the manuscripts are based on outdated publications – I suggest expanding bibliography a bit.

3. Authors use a heating chamber technique to coat aerosol particles with an organic film. How is this relevant to the ambient aerosol? Maybe some explanation how the fatty acids may end up on the ambient sea salts particles would be in order?

4. More information on the overall aerosol composition should be presented – how much of NaI or NaBr in percentage is present in the marine aerosol? Is it enough to impact the bulk hygroscopicity of the aerosol, or rather more emphasis should be put on the NaCl as it is the major compound of the marine aerosol?

Minor comments:

P4385, L6: What other physico-chemical properties? It is important.

P4385, L11: Is this really relevant here? If yes, describe a bit more.

P4385, L14: Vague. Describe better how can you quantify such link and how especially how the chemistry of sea water may influence size distribution of aerosol particles (important for models).

P4385, L17: Important papers are missing, expand this section by brief explanation of how much organics can be enriching the sea salt POA and what is the impact of enrichment on the properties of aerosol, link between biogenic activity and fraction of organics in the POA, statistics of the marine aerosol measured at coastal stations (e.g. (Bialek et al., 2012; Fierz-Schmidhauser et al., 2010; O'Dowd et al., 2004; O'Dowd et al., 2002; Ovadnevaite et al., 2011a; Ovadnevaite et al., 2011b; Vaishya et al., 2013)

P4385, L21: Again, refer to follow-up study by (Ovadnevaite et al., 2011a)

P4385, L25: What are the implications of this statement?

P4385, L29: What reaction?

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P4386, L2: those are the same processes – formation and growth depends on the hygroscopic properties of aerosol

P4386, L4: Some data for mixing state and hygroscopicity has been recently published (e.g. (Bialek et al., 2012; Dall’Osto et al., 2009) extend your bibliography in this topic.

P4386, L8 Sentence lacks citation (e.g. (Ovadnevaite et al., 2011a))

P4387, L24: What are the sources of those acids in the marine aerosol? Any newer studies?

P4388, L4: Why is this important?

P4388, L10-17: What is the flow through the system? Are all the splits isokinetic so that the same amount of particles goes to CPC, APS and FT-IR?

P4389, L2: related to major comment 3. How is this way of coating relevant to the ambient measurements? The ambient processes are not taking place in such high temperatures – is it possible that the method introduces some bias in the data when compared with natural marine aerosols? It is worth to mention this in the manuscript. What about uncertainties and errors of measurements?

P4389, L10: can you add figure showing the size distribution of generated aerosol? Comparison of treated and untreated aerosol could be of an additional value. Also, describe shortly the working principle of the FTIRS.

P4390, L13 Use “is visible” (or similar) instead of “outstands”.

P4391, L3: How it was visible in the CPC? CPC only counts particles.

P4391, L7: Explain the “surface effect in small particles”

P4391, L15: How much is slightly? Is it important for the experiment or not? Explain the indication of particle scattering and why you mention it here.

P4393, L1: According to figure 3, pure NaCl particles look much more round than those

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coated with acids (vide fig. 3a). This is rather strange providing that pure NaCl should have sharp cubes instead of roundish ovals. Is it possible that there was mix up of panels in this figure? One would expect that NaCl is represented on lower-left panel rather than on the upper-left. How the authors can be certain that upper-right panel shows LA instead of some organic artifact? (e.g. part of filter). EDX is not capable of distinguishing chemical compounds – only elements.

P4394, L1: Which wavenumber represent the C=O bond?

P4395, L6: It is worth mentioning that, in reality, water uptake by NaCl is happening before sudden deliquescence but the particles do not change their size but shape (become more “roundish” with increasing RH).

P4395, L14: Correct “theparticles”. Particles do not uptake liquid water because liquid water is not present – only water vapour.

P4397, L12: Again, in fig 3a NaCl particles are not cubic. . . .

P4398, L11: Define FWHM and explain its application in the methods sections.

P4403, L11: The sentence is vague, please explain better how specific or use different wording.

P4403, L20: reword (maybe to: . . ., while the shortest one (HA) achieves the lowest.)

Figure 1: Mark flows in the all branches of the setup.

Figure 2: Expand figures so they are easier to read and explain values in the ellipses (e.g. x10).

Figure 3: Check the panels’ order! Maybe add EDX tables for each panel so it is certain that the particles on upper-left panels are pure NaCl?

Bialek, J., Dall’Osto, M., Monahan, C., Beddows, D., O’Dowd, C. 2012. On the contribution of organics to the North East Atlantic aerosol number concentration. Environ-

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Fierz-Schmidhauser, R., Zieger, P., Vaishya, A., Monahan, C., Bialek, J., O'Dowd, C., Jennings, S., Baltensperger, U., Weingartner, E. 2010. Light scattering enhancement factors in the marine boundary layer (Mace Head, Ireland). *Journal of Geophysical Research*, 115(D20), D20204.

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Vaishya, A., Ovadnevaite, J., Bialek, J., Jennings, S.G., Ceburnis, D., O'Dowd, C.D. 2013. Bistable effect of organic enrichment on sea spray radiative properties. *Geophysical Research Letters*, 40(24), 6395-6398.

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