Responses to the reviewers:

"Elemental analysis of Oxygenated Organic Coating on Black Carbon Particles using a Soot-Particle Aerosol Mass Spectrometer" by Mutian Ma et al.

Reviewer #2

The manuscript by Ma et al. entitled 'Elemental analysis of Oxygenated Organic Coating on Black Carbon Particles using a Soot-Particle Aerosol Mass Spectrometer' focuses on validation of elemental ratio analysis by the soot-particle aerosol mass spectrometer (SP-AMS). The approach includes both laboratory and field studies. Three SP-AMSs were employed for the study, allowing inter-comparison of the data. Chemical characteristics of coating material on soot particles is important for understanding the climatic impacts of aerosol particles. The content of the manuscript is within the focus of the journal. The manuscript is well written, and easy to follow. I support publication of the manuscript after addressing the following comments.

Response: We thank for the constructive comments and questions from the reviewer. Our responses to specific comments are shown in blue color below:

Specific comments:

1. Morphology of particles for laboratory study. The authors mixed Regal Black and aqueous solution of standard organic compounds. Subsequently, particles were generated using an atomizer. I wonder how the morphology of these particles are. In the case of ambient 'coated soot particles,' coating material should be located on the surface of particles. However, the generation method could produce particles with different morphology (e.g., homogeneously mixed; light-absorbing material is coating non-absorbing material). The discussion would be more convincing if the authors could describe the potential influence of particle morphology on experimental data.

   Response: We agree with the reviewer that the laboratory-generated particles can be more spherical and homogenously mixed compared to ambient particles. It has been well known that the particle beam width of ambient BC particles strongly depends on its morphology, which can greatly affect collection efficiency of ambient BC particles due to incomplete overlapping between laser and particle beams (Willis et al., 2014). However, whether BC particle morphology can affect the fragmentation of coating materials remains poorly investigated. Since different fragmentation of organic coating observed in this work is likely due to lower vaporization temperature for those vaporized from BC particle surface, we speculate that the particle morphology may affect how fast the BC can be heated up but not the vaporization temperature of organic coating, and thus may not have significant impact on the fragmentation pattern. The general agreement of f44/f43 enhancement (i.e., the two major oxygenated fragments observed for ambient OOA) between our lab observations and field data also provide indirect evidence to support our speculation. However, we would like to highlight this uncertainty in our revised manuscript as this will require further investigation to confirm our speculation in the future as following.

   Section 3.6, page 9, line 31 – page 10 line 2: "Given that our observations that vaporization scheme plays a critical role in the fragmentation process of oxygenated organic species, the LV elemental analysis scaling factors (0.89 for H:C and 1.10 for O:C) and the I-A_{sp} method obtained in this work can facilitate more direct and robust comparison between the two types of measurements based on elemental analysis. Nevertheless, it is important to note that rBC and organics were likely more homogeneously mixed within our laboratory-generated particles, which can be very different from the morphology of ambient organically coated BC particles. Therefore, such inter-instrument comparisons assume that BC morphology is not a key factor to affect organic fragmentation observed by the LV scheme.

2. Stability of Regal Black mass spectra. The contributions of Regal Black on observed mass spectra were subtracted using a fragmentation table. I wonder if there were any differences in mass spectra of Regal Black those were observed by different instruments.

   Response: The Regal Black mass spectra can have small different between instruments. However, we observed that Regal Black mass spectra is consistently obtained from SP-AMS 1 in different calibrations. It is important to emphasized that Regal Black calibration was performed for each instrument so that the fragmentation table correction (i.e., C_1^+:C_3^+, CO^+:C_3^+ and CO_2^+:C_3^+ ratios) applied for rBC is instrument specific. This information has been added to Section 2.3 as shown below.

   Section 2.3, page 5, lines 9-10: “Regal Black calibrations were performed for each instrument and thus the applied corrections for fragmentation table were instrument specific.”

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