We are very grateful for the anonymous reviewer's positive assessments of the manuscript and insightful comments for further improvement. We have revised the manuscript by fully taking the reviewers' suggestions into account. Please find our point-to-point replies below in blue, and the specific changes in the revised manuscript and SI are highlighted here in red.

Reviewer 2

This manuscript is an interesting effort to understand secondary organic aerosol formation in a coastal site in China. It could serve as a valuable guide for further complementary studies on the differences between fine-mode and coarse-mode oxygenated organic carbon origins. I recommend minor revisions for publication. Additionally, the text should undergo a careful review for grammar and fluency, with particular attention to punctuation and spaces.

1. Why not utilize diagnostic ratios to attribute and support specific sources such as Mg2+/Na+, Cl^-/Na^+ (related to marine influence), and SO42-/NO3$^-$ (which some authors use to differentiate between stationary and vehicular sources) among the various particle sizes? It can be complementary to PMF.

Response:

Thank you very much for your insightful comment. We fully understand your suggestion regarding the use of diagnostic ratios (e.g., Mg^{2+}/Na^+, Cl^-/Na^+, and SO_4^{2-}/NO_3^-) to support source identification across particle sizes. However, the primary objective of this study was to investigate the formation mechanisms and size distribution of secondary organic aerosols (SOA), with a particular focus on water-soluble organic carbon (WSOC). Therefore, the PMF analysis was conducted using variables closely related to SOA, such as WSOC, WSOO, and selected organic fragments from the ACSM, to ensure the interpretability of SOA-related factors.

This approach follows the methodology successfully applied in our previous work (e.g., He et al., 2022; Huang et al., 2020; Wei et al., 2024), where robust and meaningful SOA source apportionment was achieved using a limited number of representative variables. While diagnostic ratios and additional species may indeed help in identifying other aerosol sources such as sea salt or anthropogenic sulfate, including too many variables could increase model uncertainty and reduce the clarity of SOA-related factors. We appreciate your suggestion and will consider incorporating such diagnostic indicators in future studies that aim to provide more comprehensive source apportionment.

2. Please provide the robustness assessment of the Positive Matrix Factorization (PMF) results, including bootstrap mapping and displacement tests, and clarify how the three-factor solution was determined (in the manuscript).

Response:

We appreciate the reviewer's suggestion. In response, we have clarified the rationale for selecting the three-factor solution in the revised manuscript. The revised sentence(line 158-160) now reads: “The three-factor solution was considered the most reasonable based on the clarity of factor profiles and the residual distribution. Further details are provided in the Supplement.”

We have provided a detailed robustness assessment of the PMF results in the revised Supplementary Information, including both bootstrap and displacement tests. As shown in the newly added Table S1 and described in Supplementary Text S1(Lines 50-53 in the revised SI), “All three factors were successfully mapped in 100% of the bootstrap (BS) runs, and no factor swaps were observed in the displacement (DISP) test. The absence of swaps indicates that the PMF results are sufficiently robust (Table S1).” These additions have been included to enhance the credibility and reproducibility of our factor identification.

Table S1. Diagnostic parameters of BS and DISP error estimates of three factors of source analytic results of PMF model

diagnostics	Diagnostic parameters	3 factors
BS diagnostics	% BS mapping	100%
	% Unmapped	0
DISP diagnostics	Error Code	0
	Largest Decrease in Q	0
	%dQ	<0.1%
	Swaps by Factor	0

Finally, in response to your suggestion that “the text should undergo a careful review for grammar and fluency, with particular attention to punctuation and spaces,” we have thoroughly proofread and revised the manuscript to address these issues and enhance the overall clarity and language quality.

Reference

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Huang, X.-F., Dai, J., Zhu, Q., Yu, K., and Du, K.: Abundant Biogenic Oxygenated Organic Aerosol in Atmospheric Coarse Particles: Plausible Sources and Atmospheric Implications, Environ. Sci. Technol., 54, 1425–1430, 2020.

Wei, F., Peng, X., Cao, L., Tang, M., Feng, N., Huang, X., and He, L.: Characterizing water solubility of fresh and aged secondary organic aerosol in $PM_{2.5}$ with the stable carbon isotope technique, Atmospheric Chem. Phys., 24, 8507–8518, 2024.