Upon review, the authors made changes that have greatly improved the manuscript. My only comment relates to the impacts of choosing not to use a sample pretreatment step prior to Py GCMS analysis.

The identification of airborne polymers using direct injection thermal techniques has been used previously, although this typically involves a double shot method that employs a thermal desorption step prior to pyrolysis (e.g. Mizuguchi et al., 2023; Chen et al., 2024; Gregoris et al., 2023). For complex samples containing suspected combustion products, it is uncertain if quantification can be performed without the use of a pretreatment step, as to my knowledge, no method-focused studies to date have been reported for these types of aerosol samples. That being said, the ability to identify polymers will rely on the specificity of the pyrolysis markers used in the Py GCMS analysis (Gregoris et al., 2023). The markers used for quantification in this study are not commonly reported in combustion samples, with the possible exception of those used for PVC quantification.

The authors report using quantification markers 1-chloroindan and dihydronaphthaleneazelene for PVC. It is not clear what the structure of these compounds are and whether or not they are applicable to PVC quantification. Chlorobenzene is a known pyrolysis product of PVC (e.g. Yang et al., 2023) and benzyl chloride has also been reported as a possible secondary reaction product between PET and PVC (Coralli et al., 2022), yet I am not familiar with the 1-chloroindan and dihydronaphthaleneazelene reported in this study. The authors should provide CAS numbers for these chemicals and also reference relevant studies that have used these markers. Since compounds similar to chlorobenzene can be produced from combustion processes, there could be a possibility of interferences in the resulting analysis without the use of a thermal pretreatment step.

I think that further discussion on the limitations of the method with regards to the lack of a pretreatment step would be warranted in this manuscript.

Response:
Dear reviewer,
We sincerely appreciate the time and effort you have dedicated to reviewing our manuscript. We have carefully addressed your suggestion and implemented the necessary revisions. Below are our detailed responses to your comments.
In this study, a single-shot pyrolysis protocol was adopted to markedly reduce analytical time while ensuring quasi-instantaneous and homogeneous thermal pyrolysis (Seeley and Lynch, 2023). This approach has been extensively applied to quantify microplastics in complex environmental samples (Watteau et al., 2018; Becker et al., 2020; Matsui et al., 2020; Lou et al., 2022; Santos et al., 2023). As the reviewer pointed out, when investigating combustion-derived particles, an additional thermal-desorption step would liberate volatile species adsorbed on the particle surface, thereby allowing a finer separation of emitted contaminants and improving accuracy. Consequently, we have explicitly addressed both the strengths and limitations of the single-shot pyrolysis strategy in the Conclusion section, and we will undertake a systematic comparison between the two approaches to Pyrolysis - GC/MS in future work. The related sentences have

been revised as follows.

"*The single-shot pyrolysis protocol used in detecting MPs in this study enables quasi-instantaneous and homogenous pyrolysis (Seeley and Lynch, 2023). However, the complex products of combustion process may lead to interference from non-polymeric components during single pyrolysis. Therefore, future work should systematically compare different pyrolysis approaches in order to improve accuracy of MPs for complex samples.*"

Regarding the qualification markers of PVC, we apologize for causing confusion to the reviewer. The markers referred to as "1-chloroindan" and "dihydronaphthaleneazelene" correspond to three compounds: 1-chloroindan ($C_9H_9Cl$, CAS 35275-62-8), 1,2-dihydronaphthalene ($C_{10}H_{10}$, CAS 447-53-0) and azulene (bicyclo[5.3.0]decapentaene) ($C_{10}H_8$, CAS 275-51-4). Previous studies often used naphthalene, fluorene and other polycyclic aromatic hydrocarbons (PAHs) compounds as PVC markers (Santos et al., 2023; Seeley and Lynch, 2023). However, according to research by Simoneit et al. (2005), PAHs are one of the major products of plastic combustion. Therefore, based on the characteristic pyrolysis products of standard (PVC material), we selected these specific compounds to achieve accurate quantification of PVC in our research.

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