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Atmospheric Measurement Techniques Discussions

Interactive comment on "Development and field-testing of an online instrument for measuring the real-time oxidative potential of ambient particulate matter based on dithiothreitol assay" *by* Joseph V. Puthussery et al.

Anonymous Referee #1

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In this work, the authors designed a novel instrument to measure oxidative potential in ambient PM2.5 on an hourly timescale. They use a mist chamber to collect particles and direct subject these particles to reaction with dithiothreitol, a model antioxidant to infer the ability of inhaled particles to cause oxidative stress. It represents an important improvement to previous filter-based methods, and while the new measurements show good agreement with measurements made using these methods, they were substantially higher. The instrument is well characterized and carefully designed. I have only one major concern about this manuscript, but I recommend publication in AMT after

addressing this and other minor concerns.

Major comment:

My only major concern is the section on comparison to composition measurements. The comparison was performed on two different time periods. While the authors claim that the composition should be similar between these two time periods, there is also no reason to believe they would be similar. For example, the diurnal variation in DTT activity may be heavily driven by a few anomalous days during July 4/5. This section is considerably weaker than the characterization tests described in the other sections. I also do not see why this comparison needs to be made in this manuscript. I believe it is sufficient to demonstrate the time-resolved capability of this instrument for this manuscript. I suggest removing this section, or re-writing this section, and performing the comparison experiments much more carefully in the future.

Other comments:

Abstract: It is confusing to read that the measurements made by MC are higher than filter-based methods, and then see slopes of less than 1. I suggest reporting the slope of MC vs filter-based method.

Introduction: The authors claim that the MC is substantially cheaper (of $\sim$150 USD) is a vast overstatement. The cost of machining the MC alone would be greater than 150 USD. Also, the authors should consider that university facilities are highly subsidized and the cost that researchers see may be substantially lower than the true cost.

Section 3.2: The tests described in this section are very appropriate. I believe that researchers in this field have largely neglected the importance of reactant concentration in determining reaction rates. Assuming a simple bimolecular reaction between DTT and PM, there should be a linear relationship between reactant concentration and measured DTT consumption, even at the same PM mass. What is puzzling me is that the authors only observe a 6% change for a 20% change in volume (or concentration).

Do the authors have any explanation for this small change? Does this suggest that the DTT reaction with PM is not bimolecular?

Section 3.4: Is there any evidence of water insoluble components in MC samples? For example, can the MC samples be filtered and the DTT measurements be repeated? Which is more biologically relevant? I can imagine the insoluble components remain in the lung lining fluid and continue to consume antioxidants.

Section 3.6.1: The authors argue that EC, Cu and Fe are all coming from traffic sources. However, the diurnal patterns are not consistent with each other. EC is higher in the morning and at night, but Cu and Fe decreases substantially at night. The authors appear to be contradicting themselves here.

Throughout the manuscript, the authors have used OP to describe DTT consumption rate per volume of air, whereas it is also often used to describe DTT consumption rate per mass of PM. I suggest defining it outright in the introduction. The per volume DTT consumption is often referred to as the “extrinsic” oxidative potential, or the oxidative capacity.

Minor technical comments:

Page 2 line 9: times

Page 2 line 10: what does it mean by “less controlled environment”. Cell-free assays would be conducted under a more well-controlled environment than cellular assays.

Page 2 line 34: the word “data” is plural; remove “a”

Page 5 line 14: “the” analytical part

Page 5 line 30: “the” analytical part

Page 7 line 19: replace “reduces” with “is reduced” or “decreases”

Page 7 line 31: “The second concern”

Section 3.3: It may be more useful to report LOD in terms of oxidative capacity in nmol DTT/(min-m3 air)

Page 9 line 24: “the time series”

Section 3.6.1: EC might be more a marker of diesel traffic

Page 11 line 24: awkward language: “getting elevated”

Page 12 line 33: there may be too many significant digits for Fe concentrations

Page 24 line 6: again, the word “data” is plural; replace “was” with “were”

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