Review of “Atmospheric conditions and composition that influence $PM_{2.5}$ oxidative potential in Beijing, China” by Steven J. Campbell et al., (MS No.: acp-2020-1024).

Based on the following four acellular assays: ascorbic acid (AA), dithiothreitol (DTT), 2-7-dichlorofluoroscin/hydrogen peroxidase (DCFH) and electron paramagnetic resonance spectroscopy (EPR), the authors of this study compared the oxidative potential (OP) and reactive oxygen species (ROS) production of $PM_{2.5}$ in Beijing summer and winter. Furthermore, the authors also analysed the correlation of $PM_{2.5}$ OP or ROS formation with different composition of $PM_{2.5}$ and concentrations of some trace gases. Overall the topic of this study is interesting. Whereas the written of the manuscript needs revision. If the authors fully address the following concerns in a revised manuscript, this work may be publishable in Atmos. Chem. Phys.

1. The manuscript title highlights the research focus of this study to be the influence of atmospheric conditions and particle composition on OP of $PM_{2.5}$. The beginning of the abstract also indicates that there exists uncertainty of the atmospheric conditions and specific chemical components of $PM_{2.5}$ driving the OP. However, the abstract did not show any new results from this study that decrease this uncertainty. A specific, quantitative, or conclusive information on the influence of which atmospheric condition and different particle components on the OP of investigated Beijing $PM_{2.5}$ is lack. Therefore, a more informative abstract is needed.
2. The motivation for using the selected four assay methods rather than other assays in this study is not well depicted. For instance, whether the AA, DTT, DCFH, and EPR assay results have closer association with adverse health effects of $PM_{2.5}$? This context should be introduced.
3. As the authors indicated in line 80-81, different acellular assays all have differing sensitivities to specific particle components that may contribute to aerosol OP. Therefore, it is not surprising to see the various performance of different assays in testing Beijing $PM_{2.5}$ (e.g., results in Figure 2). Moreover, it is reasonable to see the various correlations among different assays. The unclear thing is that why the combined application of the selected four assays has advantageous in providing new information than using individual assays?
4. Line 309-310: why the mass fraction of organic peroxides in $PM_{2.5}$ increase in winter? How can you justify?

5. The authors referred elemental carbon (EC) to be non-redox-active. However, many studies found that EC or black carbon can produce $^{\bullet}OH$ in water. Thus, it is necessary to double check this interpretation.
6. For the EPR analysis, the authors used Tempone-H as spin trap to measure the production of O_2^-. Whereas, this probe can also react with $^{\bullet}OH$ and other radicals. Moreover, Tempone-H is sensitive to the pH of solution samples. Have the authors measured the pH of $PM_{2.5}$ extracts? What is the relative fraction of O_2^- among all the detectable radicals?
7. Carefully check the type setting of the whole manuscript. For examples, proper use superscript or subscript for $PM_{2.5}$ and NH_4^+ etc.