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***Interactive comment on* “Different characteristics of char and soot in the atmosphere and their ratio as an indicator for source identification in Xi’an, China” by Y. M. Han et al.**

Anonymous Referee #1

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General comments There are numerous aspects about this manuscript that are very well done, i.e. the authors have done a thorough study, on an important topic in a critical geographical region. The paper is well written, concise, and creative and with some minor revisions is of merit for publication.

My two primary questions about this paper are in regard to the role of OP in these determinations and the generalization that the Char-EC/Soot-EC ratio is a better indicator of source than OC/EC. However, I believe that these issues can be adequately addressed by the authors.

Specific comments While the authors discuss the possibility that SOA formation in-

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terferes with the determination of OC/EC, it is unclear what uncertainty arises due to pyrolyzed organic carbon (OP in the manuscript). While in Fig. 6, there are clearly cases when the Char-EC/Soot-EC ratio may be a better indicator than OC/EC, it is clear that there are just as many cases when it is not.

One of the primary points of the manuscript is that because it is not influenced by SOA formation, the Char-EC/Soot-EC ratio is a better indicator of source than OC/EC. However, from this manuscript alone, it is unclear if I would draw this conclusion. Is the claim that the Char-EC/Soot-EC ratio is a better indicator of source than OC/EC dependent upon the relative contributions of Char-EC and Soot-EC. In this particular study, the influence of traffic (Soot-EC source) is relatively low compared to Char-EC (coal and biomass sources). Is it possible that the Char-EC/Soot-EC ratio is only better when Soot-EC is a relatively small contribution such as the present study?

Ultimately, both the OC/EC ratio and the Char-EC/Soot-EC ratio are a function of OP (equations given in words in text). Mathematically propagating the uncertainty in OP would provide some insight into the limitations of each of these methods. As the uncertainty in OP may be a function of how large the OP contribution is, examining this over a range of OP's could provide clarity on which method works better under high char conditions and which under low char conditions. It isn't obvious that the uncertainty due to SOA is always greater than that due to OP.

Lines 200-203 While the text says that the strong correlation between EC and Char-EC in Figure 2 is consistent with that observed in 14 other cities, the data that support that conclusion are provided elsewhere. Yet the correlation of EC and Char-EC is one of the primary conclusions of this manuscript. From the data presented in this paper it isn't obvious that this strong correlation doesn't arise due to the dominance of biomass burn as a source.

L230. The claim that char-EC/soot-EC has distinctive values from primary emissions is not clearly substantiated in Figure 6. In Fig. 6, this ratio, assuming the y axis should

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be Char-EC/Soot-EC (not Coal Char-EC/Soot-EC), varies from 1 to as high as 30 or 65 for coal, and from 1 to 45 for biomass burning. These ranges do not imply that this ratio is a good indicator of emissions source as claimed in the manuscript.

In the three sections, lines 33-35, 320-324 and 337-341 it is difficult to read these and see how they fit together (I have re-read them at least 4 times). In one section it says that Soot-EC is primarily affected by wet precipitation, and in another section it emphasizes its global dispersion. As written, it seems contradictory.

Technical corrections Line 61 change to Soot is composed of submicron particles of grape-like clusters formed . . .

Line 62-63 change to Char retains the morphology of the source material (current sentence doesn't make sense)

line 63-64 provide reference

line 70 "estimated to differentiate" doesn't make sense, suggest changing to either attempted to differentiate between or differentiated between

Line 86-87 This sentence doesn't make sense-check grammar.

Line 122-125 unclear provide more detail

Line 150-151 "indicated EC rank highly in Xi'an" and "that char-EC rank highly". This use of rank doesn't make sense.

Line 294 an effective indicator

Line 320 should inversion be inversion

Line 350-351 English unclear

Figure 3. Fonts are much too small to read. Is it possible to put propagated error bars on the data points? As the X axis is identical in every graph-it could be used once. Soot EC appears larger than the other sub graphs.

Figure 6. Should the word coal be deleted from the Y axis label? As the text comments that the char-EC/Soot-EC ratio depends upon the type of coal, if these are known for the data points, perhaps they could be indicated by filled and unfilled squares for bituminous and anthracite coal. Given the size of the figure, symbols could be larger,

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as well as the Font sizes.

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