

General comments:

This manuscript conducts comprehensive laboratory-based experiments to investigate gas and particulate pollutant emissions from open burning of household solid waste. The authors clearly describe the CO₂, CO, NO_x, SO₂, and PM emission factors (EFs) of ten types of solid waste materials, and discuss the possible influence factors (e.g., elemental composition, moisture content etc.). Considering different combustion phases (e.g, flaming and smoldering) in their study is a nice feature of this paper. These detailed EFs enhance the database of carbon source emission, which could apparently reduce uncertainties when compiling the emission inventory of carbon for residential combustion sector. This is an extremely important area of research for global carbon budget, and absolutely relevant for the scientific community and decision-makers. I recommend this manuscript can be accepted for publication after addressing the following issues.

Specific comments:

Comment (1) Section 2.3: Actually, the concentration of pollutant (e.g., CO₂, CO, PM etc) is always changing during the combustion phase. Here, to obtain the EFs for flaming, smoldering, and entire burning process, *C* should be the average concentration of pollutant in different burning process. If so, please clarify.

Comment (2) Section 3.1: (a). Line 190–191, Figure 3c shows that there are concentration peaks for NO and NO₂. It seems that NO_x (= NO + NO₂) had the similar peak during 0–400s compared to other pollutants. I think the real-time NO_x concentrations were close to background levels, that were mainly affected by the amount of fuel burned. The low combustion temperatures and low nitrogen content of the fuel should be the major cause of low NO_x EFs. (b). Line 198–199, why authors claim that the lower CO EFs produced by plastic bags was associated with high C and H content? In fact, high C content may lead to high CO₂ and CO emission, while the higher MCE would cause the large ratio of CO₂ to CO emission.

Comment (3) Section 3.2:

(a). Line 211–212, what are the differences between linear regressions with/without intercept in Figure 5? Could you clarify what “other combustion emissions” refers to? I suggest to include all the sample sets for combustion experiments in Figure 5. (b). The color of the filter membrane is interesting, the representative photograph of filter membrane for each waste material could be combined and added in Figure 6 to indicate OC and EC content.

Comment (4) Section 3.3: (a). Line 244, Do the authors mean that materials that have both flaming and smoldering phases have similar/comparable EFs? If yes, please present the result of T-test to prove that there is no significant difference between these data. (b). Despite Tables 2 and 3 have all the EFs data from this study and previous literatures, they still need to be described and cited in the main text.

Comment (5) Section 3.4: As shown in Table 4, most EF changes without C_{PM} and CMF_{ash} were similar to their content. However, for rubber and plastic bottle burning,

the EF changes without C_{PM} were much higher than C_{PM} content (87.0% vs. 46.5% and 576.6% vs. 85.2%). Could the authors add some explanations that why the larger C_{PM} content caused such greater EF changes.

Technical Comments:

Comment (6): The current title is bit ambiguous, leading readers to expect the study on global household solid waste combustion. I suggest to explicit that the analysis focuses on the waste materials in South Africa.

Comment (7) Line 26–27: Delete “household and” to make the abbreviation (MSW) more clearly.

Comment (8): For introduction section, (a) the second and third paragraphs for description of solid waste open burning can be merged; (2) the fourth paragraph related to risk of smoke can be deleted, since there is no discussion of toxicity in this study. I suggest the author could point out the possible link between solid waste open burning emission and global (or South Africa’s) carbon budget.

Comment (9) Line 88: Delete “organics”.

Comment (10) Line 97–98: Do “the other categories” refer to glass, metals, and ceramics? If yes, the combined materials seems to be the mixtures of all (not only the other) waste material categories based on their burned mass fractions. Please confirm.

Comment (11) Line 114: Replace “Ipcc” with “IPCC”.

Comment (12) Line 117–119: This paragraph on nitrogen and sulfur contents could be combined with the previous paragraph (both of them are elemental compositions).

Comment (13) Line 121: C% content, carbon content, or C content, it is better to write in a uniform way.

Comment (14) Line 129–132: How ignited the non-flammable materials? Do the author mean only smoldering emissions were measured until all pollutant concentrations returned to baselines, what about flaming emissions?

Comment (15) Line 141–142: Delete the sentence “CO and CO₂ concentrations were used to calculate the modified combustion efficiency (MCE) and fuel-based EFs.”

Comment (16): The instruments (e.g., ELPI, PASS-3) that are not used in this study should not be in Figure 2.

Comment (17): Correct the subscripts of CO₂ in the formula (1).

Comment (18) Line 141–142 and: Replace “~0.9” with “0.9”.

Comment (19) Line 203: Replace “rubber” with “leather/rubber”.

Comment (20) Line 206: Replace “~0.92, 0.9, and 0.8” with the MCE values reported in Table 2.

Comment (21) Line 324: The descriptions in brackets can be deleted.