Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2017-352-RC2, 2017

Atmospheric Measurement Techniques Discussions

Interactive comment on "Assessing the degree of plug flow in oxidation flow reactors (OFRs): a study on a Potential Aerosol Mass (PAM) reactor" *by* Dhruv Mitroo et al.

Anonymous Referee #1

Received and published: 25 December 2017

Mitroo et al. introduce a method to deconvolve the measured residence time distribution (RTD) from sampling tubes to get the real RTD inside the Washington University Potential Aerosol Mass (WU-PAM) reactor, which is also validated by computational fluid dynamic (CFD) simulation. The idea of this paper can help improve the understanding of RTD for the oxidative flow reactor (OFR) user community. This paper is well-written and fits the scope of AMT. I suggest for publication after considering the following aspects:

General comments:

1. I agree with Review #2's comments about the expansion of Section "5 Potential im-

plication". My concern is that how your method can be applied to simulation rather than just used to explain RTD. In other words, how does the incorporation of CSTR tank-in-series (TIS) model framework behave when compared with the PFR framework? For example, most of your inversion results indicate that the number of TIS, N, is a little bit larger than 1. Does that mean it is CSTR rather than PFR that can better represent OFR? So to simulate what happens in OFR, we should use CSTR model instead of PFR? Then the question is to what extent the difference will be introduced to the simulated results by shifting from PFR to CSTR. I think the authors should clarify these points in this section.

2. TIS model can have different forms. The authors assume the same residence time for each CSTR-tank and find the tank number. One can also take the form with a fixed CSTR (or PFR or mixed CSTR/PFR) number but to find each residence time, which looks more reasonable given the CFD simulation. Can the authors discuss this a little bit more? For example: How does the number of TIS, N, depend on the flow rate, or in other words the average residence time? Since the flow rate changes the fluid field, the mixing style could be different at different flow rates (e.g. Fig.3a-c). But I cannot see any trend. Can the author give some explanation for that?

3. Equations in Appendix B should be carefully checked. For example, in Eq. (B3) it should be $E_1|_{N-i}$ instead of $E_1|_{N-1}$. In addition, try to avoid "N", since the number of TIS is also "N", which may cause confusion. In Eq. (B8), **A** is a matrix, which should be listed as $A_{i,j}$ not just $A_{N,i}$. One more, as a vector, **B** should be listed as B_i, with $i = 1, 2, ..., N-1$ and $i = N$. About time step Δt, see following comments for Figure 3.

Specific comments:

1. Line 182: "create allow", delete either one.

2. Line 218: "F-curve", define it here or mention it later.

3. It is unnecessary to list both dimensional and non-dimensional equations at the

same time, e.g. EQ. 1-4 and 8-9, since the non-dimensional form has been introduced in detail in Appendix A.

4. Figure 2: Please use higher resolution figures and rearrange the figure locations (too compact, and x-labels are hidden).

5. Figure 3: Why time resolution is different in Panel e? Does Δt in Appendix B correspond to the time interval in Figures 3a-f?

6. Figure 5: Please use an intuitive y-label instead of “F”. Also please specify “N” value in the caption.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-352, 2017.