

The main comments the reviewer and editor had revolved around why/how Dekabon and/or Bev-A-Line XX performed so much worse than the rest of the other tubing materials. We have grouped our responses to address these major topics first, with the remaining comments addressed at the end of the document. Most of the edits can be found in Discussion Section 4.5.

Thank you both for your suggestions, time, and consideration throughout this process. You've made the first author's first publishing journey very pleasant!

### Major themes:

**Line 566:** While the Dekabon and Bev-A-Line XX liner materials are unknown, it is worth speculating on the process causing the large smoothing/wall exchange observed. Especially the H<sub>2</sub>O panel in Figure S3 begs the question of where the WVSS water physically goes (probably the liquid phase).

Response: This larger smoothing effect is probably due to a large reservoir of water molecules on and in potentially in the spaces of the polymer structure and slow flow rate of water molecules through the tubing. The editor suggested that we “try to estimate what the physical size of the reservoir must be such that it can 1) exchange with all the supplied water and 2) not be isotopically changed significantly by this exchange with the gas phase water. One could calculate whether such a scenario is physically possible from the amount of gas phase water processed through the tubing.”. In order to do this we estimated the reservoir size of water on/in the tubing from a simple residence time calculation.  $\tau = \text{reservoir size} / \text{exchange rate}$ . We assumed the maximum exchange rate of water molecules with the tubing material is equal to the rate of water vapor flowing into the tubing, calculated using the flow rate and water concentration of the experiment. We used the dD location adjusted  $t_{95\%}$  as an estimate of the residence time of water on the walls, which is likely an over estimate because  $t_{66\%}$  would be closer to a  $\tau$  estimate. This gave us an amount of water (in grams and weight percent) we might expect to find on the tubing walls for PTFE (0.0016 g or 0.0002%), Dekabon (0.13 g or 0.02%), and Bev-A-Line XX (1.72 g or 0.2%) to explain the long transition times. To evaluate the feasibility of that amount of water stored in the tubing, we compared this with published information. The grams of water that could possibly be absorbed by PTFE when fully submerged (water absorption % by tubing weight), <0.01%, leads to ~0.1 g H<sub>2</sub>O absorbed by 100 ft of PTFE tubing when submerged. For Dekabon and Bev-A-Line, we compared against absorption percentages for ethylene-vinyl alcohol copolymers from Cava, et al., 2006 to calculate possible grams of

water absorbed. If the reservoirs of Dekabon and Bev-A-Line XX are indeed anywhere near the maximum size calculated by Cava et al., for ethylene-vinyl alcohol copolymers (12% water absorbed by weight), and the exchange rate as slow as our tubing air flow rate, our results seem reasonable. Additionally, we wish to reiterate that we conducted this experiment at speeds below what would typically be found in atmospheric observations, so the total water molecule flow rate was slow enough to identify potential material wall effects. Lines 570-575 and 689-712 in the marked up main text were edited to reflect this discussion.

**Line 440: How or why is Dekabon dD and d180 transitions different?**

Response: Hydrogen bonding in general (referenced in lines 93-95, as well as newly expanded on in Discussion Sect. 4.5) causes differences in dD and d180 transition speeds. For Dekabon specifically, we have more clearly commented on the visual differences between Dekabon and the rest of the tubings in Figs. 4 and S4 in Sect. 3.3.1. We have also added additional calculations to the discussion of tubing type to Sect. 4.5 to address the differences in Dekabon and Bev-A-Line XX from the rest of the tubing types.

**Line 679: Try to give some indication/explanation of why such a factor of 71 (x difference between dD and d180 transition speeds) can exist (in Dekabon). What kind of process can be affecting dD so much more?**

Response: The magnitude of the hydrogen bonding effect on dD and d180 transition speeds is related to the amount of water on the tubing walls that is exchanged and the isotopic exchange rates. Slower exchange rates based on air flow conditions may be increasing the dD/d180 ratios we see in Dekabon compared to the other tubings. We have now added these ideas to Sect. 4.5. We also would like to point out that the flow rate is also a likely factor, as common rational is that increasing air flow rate through tubing decreases memory effects overall. Our experiments were conducted at a slow flow rate to magnify the memory effects and possible memory metric ratios. Differences in the humidity in such experiments may contribute to the variability of this ratio in other experiments. We have also added additional calculations to the discussion of tubing type to Sect. 4.5 to address the differences in Dekabon and Bev-A-Line XX from the rest of the tubing types.

**Small comments**

**L. 369: there is no table S2. Table S1? Optionally change the name of the supplement headers (S1-S6) to not match the figure and table names.**

The previous submission had supplemental tables in the pdf file and an excel file. We have removed Table S1 from the supplemental pdf document and have submitted it as another separate excel file, in keeping with Table S2 (originally submitted as a separate excel file). We have also renamed the excel files to start with "TableSX" in order to make this more explicit.

**L. 390: No location time in table S1/S2.**

Location time is in the Excel file Table S2.

**L. 609: amount -> margin**

Adjusted.

**L. 795: isotopic change -> the isotopic step change**

Adjusted.

**Supplemental: Figure S4 and Figure S9 seem to have accidental double axis labels.**

Adjusted.

## References

Cava, D., Cabedo, L., Gimenez, E., Gavara, R., and Lagaron, J. M.: The effect of ethylene content on the interaction between ethylene–vinyl alcohol copolymers and water: (I) Application of FT-IR spectroscopy to determine transport properties and interactions in food packaging films, *Polymer Testing*, 25, 254–261, <https://doi.org/10.1016/j.polymertesting.2005.09.018>, 2006.