

## ***Interactive comment on “Hydroxyl radical reactivity at the air-ice interface” by T. F. Kahan et al.***

### **Anonymous Referee #3**

Received and published: 30 November 2009

1. Does the paper address relevant scientific questions within the scope of ACP? Yes
2. Does the paper present novel concepts, ideas, tools, or data? Yes
3. Are substantial conclusions reached? Yes
4. Are the scientific methods and assumptions valid and clearly outlined? See specific comments
5. Are the results sufficient to support the interpretations and conclusions? Yes
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? See specific comments

C7659

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes
8. Does the title clearly reflect the contents of the paper? Yes
9. Does the abstract provide a concise and complete summary? Yes
10. Is the overall presentation well structured and clear? See specific comments
11. Is the language fluent and precise? Yes
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? See specific comments
14. Are the number and quality of references appropriate? Yes
15. Is the amount and quality of supplementary material appropriate? Some of the information found in the supplementary material should be in the manuscript (see specific comments)

General comments: This manuscript describes experimental reactions of OH radicals towards aromatic compounds in the quasi-liquid layer (QQL) at the air-ice interface, compared to the bulk aqueous phase, and the bulk ice phase. The methods used are relatively simple and the results obtained show that while both the bulk phases show similar behaviors, the QQL behaves very differently. An important amount of experiments are presented and well argued, and the results are discussed. The paper contains new and significant information and deserves publication. However, a number of points need to be clarified.

Specific comments:

- pp. 20883: lines 3-7: The link between hydroxyl nphotoproduction within snowpack

C7660

and organics in snow packs (cited in brackets, after citation of Domine and Shepson 2002 and Grannas et al., 2002) should be explained.

- pp. 20883: line 16: it seems that an expression is missing after "handful"
- pp. 20884: lines 10-22: previous works concerning direct photolysis of aromatic compounds are cited. If it is so, the link between this paragraph and the following one (lines 23-29), where the same papers are cited concerning indirect photolysis of the same compounds, is not clear.
- pp. 20885: lines 6-9: the last sentence should not be placed in the introduction
- pp. 20885: line 16: replace "Several types of experiments were performed:" by "Several types of complementary experiments were performed:"
- pp. 20885: lines 22- 26 and pp. 20886 lines 1- 8: recall each type of experiments cited.
- pp. 20886: line 23: Table 1 is cited where the LIF is cited whereas it has not yet been described in the text. This should be rewritten.
- pp. 20887: line 2: "The lamp's output": is it the 75 W Xenon arc lamp described earlier ?
- pp. 20887: line 6: When the samples were melted, was there any evaporation of the VOCs?
- pp. 20887: lines 9-10: specify that the further reactivity of phenol towards OH was taken into account in the results
- pp. 20887: lines 10-15: it should be mentioned that the concentrations of phenol used in Fig. 1 are 5 times lower than that of benzene, and thus, its excitation and emission spectra are 5 times more intense than that of benzene, and thus, at the chosen wavelengths, the interferences due to benzene must have been of negligible importance.

C7661

- Section 2.3: recall the type of experiment with a longer title than (b), (c), (d) or (e).
- pp. 20888: specify how the initial concentrations of reactants were chosen.
- pp. 20888: line 17: specify what is SLPM
- pp. 20890: line 11: a 100 W Xenon arc lamp is cited while a 75 W Xenon arc lamp is previously mentioned in the manuscript.
- pp. 20890: lines 26-29: what is the surface thickness? How is possible to differentiate between surface and bulk reactions?
- pp. 20892: lines 5-15: The results obtained with ice granules should be emphasized with tests performed on different ice granule diameters.
- pp. 20892: line 21 and pp. 20893: lines 2-5: specify the reaction between benzene and O<sub>2</sub>.
- pp. 20893: lines 20-29 and pp. 20894: lines 1-7: add a discussion on the different slopes obtained in fig 6 using different OH precursors, and compare with literature (see for example : Minero C., Serge Chiron, Gianpaolo Falletti, Valter Maurino, Ezio Pelizzetti, Roberto Ajassa, Maria Eugenia Carlotti and Davide Vione: chemical processes involving nitrite in surface water samples, Aquatic Sciences - Research Across Boundaries, Volume 69 (1), 71-85, 2007.)
- pp. 20896: lines 2-6. The temperature argument is not clear.
- Throughout the manuscript: the pH of the solutions should be stated and a discussion may be useful concerning this parameter.
- All figures: recall the type of experiments
- Figure 6: specify the concentrations of benzene, and the pH.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 20881, 2009.

C7662