Atmos. Chem. Phys. Discuss., 14, C5685–C5689, 2014
www.atmos-chem-phys-discuss.net/14/C5685/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Emission of iodine containing volatiles by selected microalgae species" *by* U. R. Thorenz et al.

Anonymous Referee #2

Received and published: 7 August 2014

Thorenz et al. investigated the emission of various volatile halocarbons and molecular iodine (I2) from two planktonic diatom species and a natural phytoplankton sample subjected to different ozone levels. Compared to macroalgae (results available in the literature), the emission level both of halocarbons and I2 was relatively low, even though the emission of I2 appeared to depend on iodide concentrations in seawater and ozone levels in air. This is an interesting study but I have some concerns outlined below that should be addressed before considering publication.

General comments:

1) The emission of halogenated compounds strongly depends on algal species (e.g. Tokarczyk and Moore 1994), growth stage (e.g. Moore et al. 1996) and, at least for

macroalgae, on environmental factors such as irradiance (e.g. Laturnus et al. 2004) and temperature (e.g. Nitschke et al. 2013). Thus, the authors should provide essential and detailed information about the strains examined (strain numbers), the culture/maintenance and experimental conditions (irradiance: PAR, probably UV [type of bulbs, fluorescent tubes], temperature, photoperiod) and the growth phase which cultures had reached at the time of the experiment (lag, log, stationary?). Since growth of diatoms is silica-dependent, they should also mention that this micronutrient was present (or absent?) in the f/2 growth medium used (concentration?). I am further interested in the fact why species from different geographical regions were chosen (temperate: M. helysia, Antarctic/Arctic: P. glacialis). Are these species key components in their natural habitats (bloom-forming, high abundance, high biomass)? Was the habitat temperature regime considered during maintenance and experiments?

2) Many algal species do not only release iodide into seawater (e.g. Chance et al. 2009, Nitschke et al. 2013), where it can undergo transformation (e.g. Chance et al. 2009, Bluhm et al. 2010), but they also efficiently absorb it (van Bergeijk et al. 2013). Such iodide uptake may explain the low concentration in the medium as measured by the authors. Iodine uptake is a topic that the authors should address in their discussion to place their findings into a biogeochemical context.

3) Regarding the halocarbon emission rates (Table 1), although mean values for CH3I and Ch2ICl differ slightly between "background" (which may be called "blank measurement"), P. glacialis, M. helysia and the natural plankton sample, the actual range of values is quite similar. In order to attribute the emission of these compounds to algal cells present, the authors may back up their data by statistical analyses, meaning they should provide proof that emissions rates were significantly different/higher when algae were present. I would recommend to perform either a simple t-test ("background" against "culture") or, for more information, a one-way ANOVA for each compound. If the assumptions for the t-test and the one-way ANOVA are violated, the authors can perform Mann-Whitney U-tests or Kruskal-Wallis tests, respectively. The term "signifi-

cant" can only be used when a statistical test revealed a significance. Also, the authors observed the emission of CH2I2 from P. glacialis; this finding contradicts Moore et al. (1996). Any explanation (see the following comments)?

4) Were halocarbons potentially present in the growth medium? They may not originate from algal cells. Where did the seawater used for media preparation originate from? For example, concentrations of organic iodine species can be high in coastal or near-shore waters (Wong and Cheng 1998); a fact that is neglected by the authors (see p 14581, l 10) and should be addressed.

5) Also, some bacteria are known to take up, release and emit iodine species (Amachi et al. 2001, Amachi et al. 2003). The presence of bacteria in the growth medium and/or in association with algae might have influenced the results presented. For example, the authors show that halocarbons were also emitted from pure growth medium without algal cells (Table 1: f/2 medium "background" range). Any explanation? Was the f/2 medium sterilised before usage? Were the algal strains axenic?

6) Regarding the determination of I2 emission rates, was the experimental set-up (Fig. 1) characterised for potential wall losses? I2 is quite "sticky" and large surfaces can potentially act as efficient sink for I2, implying that I2 emission rates are probably underestimated. How was this issue addressed?

7) Chlorophyll concentration can vary with environmental factors and under stress conditions; it represents therefore not the best proxy for biomass. Chlorophyll a data may be supported by cell numbers.

8) The study is placed into the field of biology and the link to atmospheric processes is relatively weak. Thus, I am not sure that ACP is a suitable journal for the work presented. In any case, before publication, the authors should address the above points.

References

Amachi S, Kamagata Y, Kanagawa T, Muramatsu Y (2001). Bacteria mediate methylation of iodine in marine and terrestrial environments. Applied and Environmental Microbiology 67: 2718-2722

Amachi S, Kasahara M, Hanada S, Kamagata Y, Shinoyama H, Fujii T, Muramatsu Y (2003). Microbial participation in iodine volatilization from soils. Environmental Science and Technology 37: 3885-3890

Bluhm K, Croot P, Wuttig K, Lochte K (2010). Transformation of iodate to iodide in marine phytoplankton driven by cell senescence. Aquatic Biology 11: 1-5

Chance R, Baker AR, Küpper FC, Hughes C, Kloareg B, Malin G (2009). Release and transformations of inorganic iodine by marine macroalgae. Estuarine and Coastal Shelf Science 82: 406-414

Laturnus F, Svensson T, Wiencke C, Öberg G (2004). Ultraviolet radiation affects emission of ozone-depleting substances by marine macroalgae: results from a laboratory incubation study. Environmental Science and Technology 38: 6605-6609

Moore RM, Webb M, Tokarczyk R (1996). Bromoperoxidasae and iodoperoxidase enzymes and production of halogenated methanes in marine diatom cultures. Journal of Geophysical Research 101: 899-908

Nitschke U, Dixneuf S, Ruth AA, Schmid M, Stengel DB (2013). Molecular iodine (I2) emission from two Laminaria species (Phaeophyceae) and impact of irradiance and temperature on I2 emission into air and iodide release into seawater from Laminaria digitata. Marine Environmental Research 92: 102-109

Tokarczyk R, Moore RM (1994). Production of volatile organohalogens by phytoplankton cultures. Geophysical Research Letters 21: 285-288

van Bergeijk SA, Javier LH, Heyland A, Manchado M, Canavate JP (2013). Uptake of iodide in the marine haptophyte Isochrysis sp. (T.ISO) driven by iodine oxidation. Journal of Phycology 49: 640-647

Wong GTF, Cheng X-H (1998). Dissolved organic iodine in marine waters: determination, occurrence and analytical implications. Marine Chemistry 59: 271-281

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 14575, 2014.