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Volatile halocarbon emissions by three tropical brown seaweeds under different irradiances

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Abstract The emission rates of eight volatile halogenated compounds by three tropical brown seaweed species collected from Cape Rachado, west coast Peninsular Malaysia, under different irradiances have been determined. A purge-and-trap sample preparation system with a gas chromatograph and mass-selective detector was used to measure a suite of halocarbons released by *Sargassum binderi* Sonder ex J. Agardh, *Padina australis* Hauck, and *Turbinaria conoides* (J. Agardh) Kützing. All species are widely distributed in Peninsular Malaysia, with *S. binderi* a dominant seaweed species at our survey site. Release of few halocarbons was found to be influenced by irradiance. Correlations were also observed between emission of certain halocarbons with photosynthetic activity, especially bromo-and iodinated compounds ($0.6<r<0.9$; $p<0.01$) suggesting that environmental factors such as light can affect the release of these volatile halogenated compounds by the seaweeds into the atmosphere. Compared with temperate and polar brown seaweeds, tropical species, such as *T. conoides*, may emit higher levels of bromoform, $CHBr_3$, and other halocarbons. It is therefore important to investigate the contribution of tropical seaweeds towards the local atmospheric composition of halocarbons.

Keywords Brown seaweeds · Tropical · Volatile halocarbons · Emission · Irradiance · F_v/F_m

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Introduction

The role of halogens in stratospheric ozone destruction has been well documented since the discovery of the ozone hole over Antarctica in 1985 and the ensuing research into stratospheric halogen chemistry (McElroy et al. 1986). Early research concentrated on the anthropogenically produced halocarbons, such as chlorofluorocarbons and halons, leading to the development of the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987 which has now been ratified by all of the world's nations. The Montreal Protocol has led to the controlled production of certain anthropogenic ozone-depleting substances. There is, however, recent evidence that much shorter-lived halocarbons of largely biogenic origin might contribute to the ozone-depleting halogen loading in the stratosphere (Laube et al. 2008), possibly transported there by deep tropical convection (Aschmann et al. 2009). Changes in