**Supplemental Information**

**Dynamic Response of Light Absorption by PM2.5 Bound Water-Soluble Organic Carbon (WSOC) to Heterogeneous Oxidation**

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**Figure S1. Results of the ‘blank’ experiments. Absorption spectra of the aqueous extracts of the filter paper sectors with organic carbon irradiated directly (red line) and by wrapping the cuvette with Al-foil (blue line) for 24 h. The black line represents the absorption spectrum of the aq. extract of the fresh sample. Wavelength dependent mass absorption coefficients (MAC) are plotted in y-axis. The MAC values at 365 nm and estimated total organic carbon content of each aqueous extracts are shown inside the figure.**

**Actinometric estimation of the photon flux of the lamp**

The actinic flux of our lamp was estimated following the method described by Lin et al., 2016 andusing 2-nitroenzaldehyde (2NB) as an actinometer (Galbavy et al., 2010). 2NB undergoes intramolecular photoisomerization to produce primarily 2-nitrosobenzoic acid, which absorbs at 313 nm. 10µM 2-nitrobenzaldehyde (2NB) aqueous solution was prepared in Milli-Q water without pH adjustment and irradiated under the same conditions as the BrC solutions. Fig. S2a shows the wavelength dependent absorption of 2NB at different photolysis times. The rate of change in photoproduct concentration (*c*) was derived from the absorbance at 313 nm versus irradiation time plot (Fig. S2b) using Beer’s law (Eq. S1),

......................Eq. S1

where is the rate of change of absorbance of the photoproducts formed during photolysis which was calculated from the time-dependent linear regression plot of absorbance at 313 nm (Fig. S2b) and *l* = 1cm, is the path length of the cuvette. The absorption coefficient ε ≈ 1003 at 313 nm was estimated by a calibration curve (Fig. S2c) from eight independent stock solutions.

The value of was used to calculate the moles of photons per unit time absorbed by the solution using Eq. S2,

......................Eq. S2

where V (= 0.003L) is the volume of solution and ≈ 0.40 is the photoisomerization quantum yield of 2NB. Finally, assuming all actinic photons were absorbed by the solution, the effective actinic flux of the lamp was estimated using Eq. S3,

......................Eq. S3

where NA (= ) is the Avogadro number and *a* (= 2cm x 1cm) is the area of the beam of light.

The yearly average solar actinic flux over Kolkata (22.5726 ON, 88.3639 OE) at 12:00 noon was calculated by integrating the photon flux at each wavelength for the wavelength region of 280-500 nm of the solar spectra (Eq. S4) using Tropospheric Ultraviolet and Visible (TUV) radiation model (http://cprm.acom.ucar.edu/Models/TUV/Interactive\_TUV/).

......................Eq. S4

Therefore, by using and , the factor scaling the photolysis under lamp and sun is calculated to be ~ 4, which means one-hour irradiation under lamp corresponds to approximately 4 hours irradiation under the aforementioned conditions.

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**Figure S2. Results of actinometry to determine the photon flux of the lamp. (a) Wavelength dependent absorption spectra of 2NB ( = 10μM) at different photolysis times. (b) Change in absorbance of 2NB at 313 nm with irradiation time and the slope of the linear regression represents the dA/dt in Eq. S1. (c) Linear fit of the absorbance at 313 nm against corresponding concentrations of 2NB. The slope represents the molar absorption coefficients (ε) in Eq. S1.**

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**Figure S3. Standard curve of absorbance at 350 nm (y-axis) *versus* anhydrous dextrose mass concentrations (x-axis) representing the organic carbon (OC) mass concentration by modified Walkley-Black method. Inset: UV-VIS absorption spectra of the remaining dichromate () after reduction with different anhydrous dextrose concentrations. The black dotted spectrum describes a typical water-soluble organic carbon (WSOC) sample.**

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**Figure S4. (a & c) Absorbance *versus* concentration profile of water-soluble organic carbon (WSOC) and 2-nitrobenzaldehyde (2NB), respectively. (b & d) Wavelength dependent variation of molar absorption coefficients (ε) of WSOC and 2NB, respectively. (e & g) Linear fits of natural logarithms of the ratio of fresh and aged absorbance of 2NB and WSOC, respectively, against corresponding irradiation times to determine the rate constant (*j*). (f & h) Wavelength dependent variations of the rate constants of 2NB and WSOC, respectively. The error bars represent standard deviations of three individual experimental values.**

**References**

Lin, P., Aiona, P. K., Li, Y., Shiraiwa, M., Laskin, J., Nizkorodov, S. A., & Laskin, A. (2016). Molecular Characterization of Brown Carbon in Biomass Burning Aerosol Particles. *Environmental Science & Technology, 50*(21), 11815-11824. doi: 10.1021/acs.est.6b03024

Galbavy, E. S., Ram, K., & Anastasio, C. (2010). 2-Nitrobenzaldehyde as a chemical actinometer for solution and ice photochemistry. *Journal of Photochemistry and Photobiology A: Chemistry, 209*(2), 186-192. doi: https://doi.org/10.1016/j.jphotochem.2009.11.013