***Supplementary Material***

**Optical Properties and Photochemical Transformation of the Dissolved Organic Matter Released by *Sargassum***

**Supplementary Methods**

***Sargassum* collection and** **exudation experiments**

**Indoor exudation experiments.** *Sargassum* was collected by net and housed onboard the R/V *Hugh R. Sharp* in a tank (< 3 days) with continuously flowing seawater before it was transported to the Chesapeake Biological Laboratory (CBL). At CBL, *Sargassum* was rinsed with artificial seawater (Instant Ocean at salinity = 35) that had previously been UVC-treated to remove dissolved organic carbon using a recirculating system and a 185 nm mercury light (Neotech Aqua Solutions, Inc.). Rinsed *Sargassum* was then placed in a large tank containing the same artificial seawater and was also recirculated through the Neotech UVC system. After 24 h, *Sargassum* subsamples were transferred to small tanks containing 7 L of UVC treated artificial seawater (salinity = 35). These tanks had been previously cleaned by soaking them in pH 2 (0.001 M HCl, Sigma Aldrich 32 %, puriss p.a.) ultrapure water for 24 hours, followed by several rinses of ultrapure water, and finally followed by three rinses of UVC-treated artificial seawater. All tanks were equipped with Radion LED lamps (Eco Tech Marine), which were set on a 14 h day/10 h night cycle, and water temperature was maintained at 29°C with Eheim Jager TruTempQuantum heaters. After another 24 h, the water was drained and replaced we began monitoring the exudation DOM optical properties from the *Sargassum* samples. These experiments, which were conducted within one week of their arrival at CBL, are listed as indoor “non-stress conditions” in tables and throughout the manuscript because there were no visible changes in *Sargassum* appearance from the time of initial collection.

**Mid-senescent exudation experiments.** After approximately two weeks post collection, *Sargassum* housed in the large tank at CBL began to degrade. The *Sargassum* was both visibly discolored and was only partially buoyant. Therefore, a few subsamples were selected for exudation experiments in small tanks, as described above. These experiments are described as “mid-senescent” throughout the manuscript.

**Outdoor exudation experiments.** *Sargassum* used in outdoor experiments was collected by net aboard the R/V *Henry Stommel*,9 km off the coast of Bermuda, and was kept in buckets of seawater until returning to the Bermuda Institute of Ocean Sciences (BIOS). Thereafter, and within 2 h of collection, *Sargassum* was placed in an outdoor tank with continuously flowing seawater (salinity = 36.5). After 24 h, *Sargassum* subsamples were placed in small isolated tanks within the large outdoor tank. Despite using no temperature control, these tanks were maintained at 27°C (checked using HOBO® pendant temperature/light data loggers) by being surrounded by continuously flowing seawater. These tanks were either exposed to solar irradiation (left uncovered) or covered with Plexiglas (irradiation cut off at 345 nm and 65% UVA transmission). These experiments were also referred to as “non-stress conditions” in tables and throughout the manuscript, with the distinction that some tanks were exposed to sunlight (“uncovered/with UV”) and others were covered with Plexiglas (“covered/no UV”).

**Supplementary Table S1.** Increases in CDOM absorption coefficients (*a*(λ), m-1) (or CDOM release rates, *Ra*(λ)) determined by linear regression of *a*(λ) at 305 and 412 nm (m-1), normalized to *Sargassum* biomass (g in wet weight) per liter (L), versus time (h) (Equation 2). Pooled *Ra*(λ) values were determined by linear regression of all normalized absorption coefficients versus time for each incubation type and compared using analysis of covariance. Spectral slope coefficients from 300 to 500 nm (*S*(300-500), nm-1, Equation 3) are averages for samples collected between 4 h and up to 46 h of exudation. *S*(300-500) values for each incubation type were compared using 1-way analysis of variance.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Non-stress conditions** | **Biomass (g)** | **Volume (L)** | ***Ra*(305) (x 10-3 m-1 L g-1biomass h-1) (r2)** | ***Ra*(412) (x 10-3 m-1 L g-1biomass h-1) (r2)** |
| Indoor 28 h | 108 | 6.8 | 63 ± 4.0 (0.96) | 13 ± 1.1 (0.93) |
| Indoor 36 h | 82 | 6.2 | 80 ± 5.6 (0.97) | 13 ± 1.1 (0.95) |
| Indoor 36 h | 96 | 6.5 | 53 ± 2.9 (0.96) | 9.0 ± 0.9 (0.94) |
| Indoor 36 h | 98 | 7.2 | 49 ± 1.6 (0.99) | 10 ± 0.6 (0.97) |
| Outdoor Plexiglas 22 h | 100 | 7.3 | 53 ± 6.6 (0.91) | 9.7 ± 1.1 (0.93) |
| Outdoor Plexiglas 47 h | 67 | 4.2 | 42 ± 1.8(0.98) | 7.1 ± 0.3 (0.97) |
| **Pooled (no UV)** | ***S*(300-500) (nm-1)** | | ***Ra*(305) (x 10-3 m-1 L g-1biomass h-1) (r2)** | ***Ra*(412) (x 10-3 m-1 L g-1biomass h-1) (r2)** |
|  | 0.016 ± 0.001 | | 47 ± 3.4 (0.77) | 8.3 ± 0.6 (0.77) |
|  | **Biomass(g)** | **Volume (L)** | ***Ra*(305) (x 10-3 m-1 L g-1biomass h-1) (r2)** | ***Ra*(412) (x 10-3 m-1 L g-1biomass h-1) (r2)** |
| Outdoor no cover 47 h | 68 | 3.4 | 64 ± 2.7 (0.98) | 12 ± 0.5 (0.98) |
| Outdoor no cover 28 h | 115 | 7.3 | 74 ± 4.8 (0.97) | 15 ± 0.7 (0.98) |
| Outdoor no cover 27 h | 143 | 3.3 | 91 ± 4.6 (0.99) | 19 ± 1.2 (0.98) |
| Outdoor no cover 30 h | 152 | 4.7 | 68 ± 4.9 (0.98) | 12 ± 0.7 (0.99) |
| **Pooled (with UV)** | ***S*(300-500) (nm-1)** | | ***Ra*(305) (x 10-3 m-1 L g-1biomass h-1) (r2)** | ***Ra*(412) (x 10-3 m-1 L g-1biomass h-1) (r2)** |
|  | 0.014 ± 0.001 | | 63 ± 4.6 (0.85) | 12 ± 1.0 (0.83) |
| (no UV versus with UV) | *p*-value <0.001\*\* | | *p-*value = 0.17 | *p-*value = 0.011\* |
| **Mid-senescent (no UV)** | **Biomass (g)** | **Volume (L)** | ***Ra*(305) (x 10-3 m-1 L g-1biomass h-1) (r2)** | ***Ra*(412) (x 10-3 m-1 L g-1biomass h-1) (r2)** |
| Indoor 48 h | 59 | 6.5 | 77 ± 6.5 (0.95) | 12 ± 1.4 (0.90) |
| Indoor 48 h | 24 | 6.5 | 130 ± 9.3 (0.96) | 21 ± 1.5 (0.96) |
| Indoor 48 h | 35 | 6.5 | 80 ± 5.0 (0.97) | 15 ± 0.9 (0.97) |
| Indoor 48 h | 36 | 6.5 | 110 ± 10 (0.94) | 18 ± 2.0 (0.92) |
| **Pooled (Mid-senescent)** | ***S*(300-500) (nm-1)** | | ***Ra*(305) (x 10-3 m-1 L g-1biomass h-1) (r2)** | ***Ra*(412) (x 10-3 m-1 L g-1biomass h-1) (r2)** |
|  | 0.017 ± 0.001 | | 100 ± 8.5 (0.78) | 16 ± 1.3 (0.80) |
| (versus no UV) | *p-*value = 0.054 | | *p-*value <0.001\*\* | *p-*value <0.001\*\* |
| (versus with UV) | *p-*value <0.001\*\* | | *p-*value <0.001\*\* | *p-*value = 0.013\* |

**Supplementary Table S2.** Average maximum fluorescence apparent quantum yield (Φ(λmax) ± 1 SD) values after ~4 h incubation (average incubation time also listed ± 1 SD), determined using Equation 5. Rates of fluorescence peak increases (*R*F) were determined by linear regression of conventional peak intensities (RU) normalized to *Sargassum* biomass per volume (g in wet weight L-1) versus time (h) (Equation 4). Pooled values were determined by averages (Φ(λmax)) and pooled rates were determined linear regression of all normalized fluorescence intensities versus time for each incubation type and compared using 1-way analysis of variance (Φ(λmax)) and by analysis of covariance (rates). Pooled values/rates for various experimental conditions are in italics.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Non-stress conditions** | **Time (h)** | **λmax** | **Φ(λmax)** | ***R*F T peak (RU L g-1 h-1) (r2)** | ***R*F A peak (RU L g-1 h-1) (r2)** | ***R*F C peak (RU L g-1 h-1) (r2)** |
| Indoor 28 h | 13 ± 7 | 372 ± 4 | 0.0040 ± 0.0004 | 0.024 ± 0.009 (0.43) | 0.093 ± 0.006 (0.97) | 0.066 ± 0.012 (0.76) |
| Indoor 36 h | 18 ± 12 | 366 ± 4 | 0.0026 ± 0.0002 | 0.037 ± 0.003 (0.95) | 0.083 ± 0.003 (0.99) | 0.069 ± 0.003 (0.99) |
| Indoor 36 h | 18 ± 12 | 374 ± 20 | 0.0035 ± 0.0007 | 0.033 ± 0.002 (0.97) | 0.059 ± 0.004 (0.98) | 0.049 ± 0.003 (0.98) |
| Indoor 36 h | 18 ± 12 | 381 ± 5 | 0.0043 ± 0.0015 | 0.038 ± 0.004 (0.94) | 0.057 ± 0.003 (0.98) | 0.045 ± 0.002 (0.99) |
| Outdoor Plexiglas 22 h | 10 ± 6 | 382 ± 2 | 0.0039 ± 0.0003 | 0.034 ± 0.007 (0.79) | 0.051 ± 0.008 (0.87) | 0.039 ± 0.010 (0.72) |
| Outdoor Plexiglas 47 h | 27 ± 12 | 380 ± 14 | 0.0035 ± 0.0002 | 0.025 ± 0.002 (0.93) | 0.046 ± 0.003 (0.96) | 0.039 ± 0.003 (0.95) |
| *Pooled (no UV)* | *All*  *<18 h*  *>18 h* | *376 ± 12*  *380 ± 14*  *372 ± 7* | *0.0036 ± 0.0008*  *0.0039 ± 0.0010*  *0.0034 ± 0.0005* | *0.026 ± 0.002 (0.70)* | *0.052 ± 0.004 (0.75)* | *0.041 ± 0.004 (0.69)* |
| Outdoor no cover 47 h | 27 ± 12 | 387 ± 8 | 0.0030 ± 0.0003 | 0.033 ± 0.003 (0.89) | 0.053 ± 0.003 (0.97) | 0.035 ± 0.002 (0.97) |
| Outdoor no cover 28 h | 13 ± 9 | 387 ± 3 | 0.0038 ± 0.0005 | 0.035 ± 0.012 (0.55) | 0.052 ± 0.012 (0.72) | 0.039 ± 0.006 (0.82) |
| Outdoor no cover 27 h | 22 ± 9 | 379 ± 7 | 0.0022 ± 0.0003 | 0.032 ± 0.002 (0.97) | 0.055 ± 0.004 (0.98) | 0.035 ± 0.003 (0.96) |
| Outdoor no cover 30 h | 20 ± 10 | 399 ± 6 | 0.0031 ± 0.0005 | 0.026 ± 0.002 (0.98) | 0.053 ± 0.004 (0.98) | 0.034 ± 0.004 (0.96) |
| *Pooled (with UV)* | *All*  *<18 h*  *>18 h* | *387 ± 9*  *386 ± 9*  *387 ± 9* | *0.0031 ± 0.0007*  *0.0035 ± 0.0007*  *0.0023 ± 0.0005* | *0.030 ± 0.003 (0.77)* | *0.048 ± 0.003 (0.87)* | *0.031 ± 0.002 (0.84)* |
| *(no UV vs. with UV)* |  | *p-*value = 0.018\* | *p-*value = 0.004\* | *p-*value = 0.83 | *p-*value = 0.93 | *p-*value = 0.42 |
| **Mid-senescent** |  |  |  |  |  |  |
| Indoor 48 h | 25 ± 14 | 370 ± 4 | 0.0031 ± 0.0003 | 0.024 ± 0.010 (0.45) | 0.104 ± 0.007 (0.96) | 0.077 ± 0.005 (0.97) |
| Indoor 48 h | 25 ± 14 | 381 ± 19 | 0.0035 ± 0.0003 | 0.047 ± 0.016 (0.52) | 0.183 ± 0.013 (0.96) | 0.129 ± 0.007 (0.98) |
| Indoor 48 h | 25 ± 14 | 409 ± 20 | 0.0037 ± 0.0004 | 0.015 ± 0.010 (0.20) | 0.104 ± 0.005 (0.98) | 0.068 ± 0.003 (0.99) |
| Indoor 48 h | 25 ± 14 | 400 ± 31 | 0.0028 ± 0.0002 | 0.042 ± 0.016 (0.46) | 0.133 ± 0.008 (0.97) | 0.106 ± 0.006 (0.98) |
| *Pooled (Mid-sen.)* | *All*  *<18 h*  *>18 h* | *391 ± 25*  *403 ± 22*  *384 ± 24* | *0.0033 ± 0.0005*  *0.0033 ± 0.0006*  *0.0033 ± 0.0004* | *0.032 ± 0.007 (0.33)* | *0.130 ± 0.011 (0.79)* | *0.094 ± 0.008 (0.79)* |
| *(Mid-sen. Vs. no UV)* |  | *p-*value = 0.005\* | *p-*value = 0.14 | *p-*value = 0.61 | *p-*value = <0.001\*\* | *p-*value = <0.001\*\* |
| *(Mid-sen. Vs. with UV)* |  | *p-*value = 0.69 | *p-*value = 0.37 | *p-*value = 0.96 | *p-*value = <0.001\*\* | *p-*value = <0.001\*\* |

**Supplementary Table S3.** Mass normalized absorbance (A(λ)/(DOC×L), m-1 L mg-1), where L is the spectrophotometer cell pathlength (m) and spectral slope values from 300 to 500 nm (*S*(300-500), nm-1) before SPE (sample pH ~8) and after SPE at various pH values listed. Percent change between samples before and after SPE is listed in parenthesis with SPE-DOM samples at pH 8. SPE-DOM samples are untreated unless otherwise listed. SPE-DOM samples with additional treatments are listed as UNT for untreated, RED for borohydride reduced and IRRAD for irradiated, as described in Section 2.3 and 2.4. Percent change (Δ) in mass normalized absorbance and spectral slopes due to pH were calculated as follows: ΔpH-pHref = 100×(VpH – VpHref)/VpHref\_UNT, where VpH is the normalized A/DOC or *S* value at the pH tested, and VpHref is the value at the reference pH, and VpHref\_UNT is the value at the reference pH of the untreated sample if other treatments were tested.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample** | **pH** | **A(305)/(DOC×L)** | | | | **A(412)/(DOC×L)** | | | | ***S*(300-500)** | | | |
| **Before SPE** | **SPE-DOM** | | | **Before SPE** | **SPE-DOM** | | | **Before SPE** | **SPE-DOM** | | |
| **Mid-senescent 48 h** | 3  7  8  10  Δ10-3  Δ7-3  Δ10-7 | 2.47 | 2.73  3.10  3.15 (+28%)  3.50  +28%  +14%  +13% | | | 0.408 | 0.559  0.658  0.677 (+ 66%)  0.789  +41%  +18%  +20% | | | 0.0161 | 0.0147  0.0145  0.0146 (-2.8%)  0.0142  -3.5%  -0.81%  -2.8% | | |
| **Outdoor stress (26°C to 49°C) 12 h** | 3  7  8  10  Δ10-3  Δ7-3  Δ10-7 | 0.595 | 2.50  2.88  2.94 (+390%)  3.09  +24%  +15%  +7.2% | | | 0.126 | 0.488  0.653  0.709 (+460%)  0.789  +62%  +34%  +21% | | | 0.0132 | 0.0138  0.0128  0.0125 (-5.9%)  0.0123  -11%  -7.7%  -3.5% | | |
| **Outdoor no cover 27 h** | 3  7  8  10  Δ10-3  Δ7-3  Δ10-7 | 3.68 | 2.97  3.56  3.64 (-1.2%)  3.76  +26%  +19%  +23% | | | 0.743 | 0.586  0.790  0.879 (+18%)  0.968  +65%  +35%  +23% | | | 0.0133 | 0.0133  0.0121  0.0118 (-12%)  0.0115  -14%  -9.2%  -4.9% | | |
| **Outdoor no cover 30 h** | 3  7  8  10  Δ10-3  Δ7-3  Δ10-7 | 2.16 | 2.99  3.33  3.43 (+59%)  3.69  +24%  +11%  +11% | | | 0.371 | 0.592  0.758  0.841 (+130%)  0.953  +61%  +28%  +26% | | | 0.0149 | 0.0148  0.0138  0.0131 (-12%)  0.0127  -14%  -6.7%  -8.3% | | |
|  |  |  | **UNT** | **RED** | **IRRADa** |  | **UNT** | **RED** | **IRRADa** |  | **UNT** | **RED** | **IRRADa** |
| **Outdoor Plexiglas 47 h** | 3  7  8  10  Δ10-3  Δ7-3  Δ10-7 | 2.26 | 2.29  2.45  2.51 (+14%)  2.77  +22%  +8.5%  +12% | 1.23  1.46  1.49  1.58  +15%  +11%  +4.7% | 1.23  1.46  1.49  1.58  +21%  +8.2%  +12% | 0.356 | 0.439  0.513  0.555 (+66%)  0.679  +55%  +22%  +27% | 0.153  0.188  0.203  0.231  +17%  +8.0%  +8.0% | 0.202  0.255  0.280  0.341  +32%  +12%  +16% | 0.0162 | 0.0153  0.0148  0.0144 (-12%)  0.0135  -12%  -4.3%  -8.0% | 0.0186  0.0189  0.0187  0.0184  -1.0%  +2.0%  -3.0% | 0.0164  0.0155  0.0150  0.0141  -14%  -5.4%  -8.6% |
| **Outdoor no cover 47 h** | 3  7  8  10  Δ10-3  Δ7-3  Δ10-7 | 2.06 | 2.71  2.93  3.04 (+48%)  3.27  +21%  +8.2%  +12% | 1.41  1.70  1.74  1.90  +18%  +11%  \_6.7% | 1.61  1.86  1.98  2.11  +19%  +9.1%  +8.7% | 0.381 | 0.577  0.682  0.746 (+96%)  0.872  +51%  +18%  +28% | 0.174  0.206  0.213  0.259  +15%  +5.5%  +7.9% | 0.295  0.386  0.429  0.517  +39%  +16%  +19% | 0.0150 | 0.0142  0.0137  0.0133 (-6.3%)  0.0125  -12%  -3.4%  -8.7% | 0189  0.0197  0.0205  0.0198  +4.4%  +4.2%  +0.17% | .0160  0.0152  0.0147  0.0137  -14%  -5.4%  -9.4% |

aDOC concentrations were not measured post irradiation for these samples. These values assume a 10% DOC loss during irradiation based on results from experiments where DOC was measured.

**Supplementary Table S4.** Photodegradation kinetics for *Sargassum* DOM optical properties determined by Equation 6 (absorption coefficients) and Equation 7 (fluorescence intensities) for various optical properties normalized to initial (t = 0h) conditions over 20 h of irradiation. Sample values in parentheses are %loss of each parameter over 20 h. All other values are averages ± 1 standard deviation for duplicate experiments, except for *Sargassum* SPE-DOM in seawater and SRNOM in pure water, where only one experiment was run.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Sample (%loss)** | ***k*a (h-1)** | **½ life (h)** | ***F*1** | ***k*1 (h-1)** | ***F*2** | ***k*2(h-1)** |
| ***a*(305)** | Whole water (37 ± 0.4) | 0.022 ± 0.001 | 31.0 ± 1.1 |  |  |  |  |
|  | SPE-DOM pure water (26 ± 3) | 0.015 ± 0.002 | 46.8 ± 5.6 |  |  |  |  |
|  | SPE-DOM seawater (33) | 0.020 | 35.1 |  |  |  |  |
|  | SRNOM (14) | 0.007 | 95.2 |  |  |  |  |
| ***a*(412)** | Whole water (53 ± 2.4) | 0.035 ± 0.003 | 19.8 ± 1.4 |  |  |  |  |
|  | SPE-DOM pure water (34 ± 2) | 0.020 ± 0.002 | 34.8 ± 4.0 |  |  |  |  |
|  | SPE-DOM seawater (49) | 0.032 | 21.7 |  |  |  |  |
|  | SRNOM (25) | 0.013 | 51.6 |  |  |  |  |
| **C-peak** | Whole water (44 ± 10) |  |  | 0.287 ± 0.058 | 1.12 ± 0.267 | 0.675 ± 0.049 | 0.010 ± 0.006 |
|  | SPE-DOM pure water (30 ± 4) |  |  | 0.186 ± 0.019 | 0.739 ± 0.070 | 0.789 ± 0.021 | 0.004 ± 0.002 |
|  | SPE-DOM seawater (36) |  |  | 0.233 | 0.764 | 0.740 | 0.007 |
|  | SRNOM (36) |  |  | 0.224 | 0.662 | 0.759 | 0.009 |
| **FI(348/450)** | Whole water (67 ± 6) |  |  | 0.415 ± 0.052 | 0.972 ± 0.165 | 0.536 ± 0.045 | 0.025 ± 0.007 |
|  | SPE-DOM pure water (53 ± 4) |  |  | 0.339 ± 0.028 | 0.693 ± 0.010 | 0.629 ± 0.035 | 0.016 ± 0.003 |
|  | SPE-DOM seawater (57) |  |  | 0.344 | 0.700 | 0.614 | 0.019 |
|  | SRNOM (60) |  |  | 0.341 | 0.626 | 0.623 | 0.023 |
| **FI(412/500)** | Whole water (69 ± 11) |  |  | 0.488 ± 0.034 | 1.62 ± 0.207 | 0.494 ± 0.050 | 0.030 ± 0.013 |
|  | SPE-DOM pure water (62 ± 6) |  |  | 0.426 ± 0.026 | 0.833 ± 0.101 | 0.550 ± 0.032 | 0.021 ± 0.003 |
|  | SPE-DOM seawater (65) |  |  | 0.412 | 1.28 | 0.550 | 0.026 |
|  | SRNOM (76) |  |  | 0.480 | 1.05 | 0.458 | 0.035 |

**Supplementary Table S6.** Intensity weighted average (wt) molecular characteristic of *Sargassum* SPE-DOM when exposed to simulated sunlight a various time points. Average characteristics for *m/z* ions with increasing (Inc.) and decreasing (Dec.) intensity between time points are also listed.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Time (h)** | **Masswt** | | **O/Cwt** | | **H/Cwt** | | **DBEwt** | | **AImod\_wt** | | **COSwt** | |
| 0 | 322 ± 78 | | 0.50 ± 0.16 | | 1.13 ± 0.42 | | 7.5 ± 3.3 | | 0.35 ± 0.25 | | -0.13 ± 0.65 | |
| 22 | 320 ± 71 | | 0.50 ± 0.17 | | 1.11 ± 0.42 | | 7.6 ± 3.3 | | 0.36 ± 0.24 | | -0.12 ± 0.67 | |
| 46 | 315 ± 70 | | 0.47 ± 0.16 | | 1.24 ± 0.42 | | 6.7 ± 3.2 | | 0.29 ± 0.25 | | -0.30 ± 0.65 | |
| **Interval (h)** | **Masswt** | | **O/Cwt** | | **H/Cwt** | | **DBEwt** | | **AImod\_wt** | | **COSwt** | |
|  | **Inc.** | **Dec.** | **Inc.** | **Dec.** | **Inc.** | **Dec.** | **Inc.** | **Dec.** | **Inc.** | **Dec.** | **Inc.** | **Dec.** |
| 0 – 2 h | 343 ± 90 | 339 ± 100 | 0.32 ± 0.17 | 0.57 ± 0.16 | 1.30 ± 0.54 | 1.14 ± 0.37 | 7.5 ± 3.0 | 7.6 ± 4.9 | 0.31 ± 0.35 | 0.31 ± 0.30 | -0.65 ± 0.82 | 0.003 ± 0.97 |
| 0 – 4 h | 342 ± 94 | 352 ± 107 | 0.37 ± 0.18 | 0.57 ± 0.16 | 1.25 ± 0.55 | 1.14 ± 0.40 | 7.6 ± 4.9 | 7.8 ± 3.3 | 0.33 ± 0.38 | 0.31 ± 0.31 | -0.50 ± 0.86 | 0.006 ± 0.97 |
| 0 – 6 h | 339 ± 94 | 357 ± 110 | 0.38± 0.18 | 0.57 ± 0.16 | 1.25 ± 0.54 | 1.14 ± 0.37 | 7.4 ± 4.9 | 7.8 ± 3.3 | 0.32 ± 0.37 | 0.30 ± 0.30 | -0.49 ± 0.86 | 0.004 ± 0.97 |
| 0 – 22 h | 334 ± 93 | 357 ± 111 | 0.48 ± 0.20 | 0.51 ± 0.17 | 1.08 ± 0.46 | 1.24 ± 0.38 | 8.1 ± 4.1 | 7.3 ± 3.5 | 0.39 ± 0.38 | 0.26 ± 0.28 | -0.12 ± 0.98 | -0.23 ± 0.82 |
| 0 – 46 h | 302 ± 77 | 342 ± 98 | 0.41 ± 0.16 | 0.57 ± 0.15 | 1.54 ± 0.34 | 0.89 ± 0.38 | 4.8 ± 3.1 | 9.5 ± 3.3 | 0.14 ± 0.22 | 0.48 ± 0.44 | -0.70 ± 0.55 | 0.25 ± 1.2 |
| 22 – 46 h | 298 ± 73 | 325 ± 85 | 0.40 ± 0.14 | 0.56 ± 0.15 | 1.56 ± 0.28 | 0.80 ± 0.35 | 4.4 ± 2.6 | 9.9 ± 3.4 | 0.11 ± 0.17 | 0.55 ± 0.49 | -0.76 ± 0.43 | 0.31 ± 1.2 |



**Supplementary Figure S1.** CDOM absorption coefficient spectra (*a*(λ)) normalized to *Sargassum* biomass in wet weight (g) per tank volume (L) at various time points (h) over the course of exudation experiments (where blue colors are early time points < 10 h and red colors are later time points > 40 h). Normalized CDOM spectra released from healthy *Sargassum* in tanks under LED lights or sunlight with a Plexiglas cover (no UV exposure) are shown **(A)** and that from *Sargassum* in tanks under natural sunlight (with UV exposure) are shown in (**B)**. Normalized CDOM spectra from *Sargassum* in tanks that had no UV exposure but were in mid-senescent conditions are shown in (**C)**, and note the different scales in **(A)** and **(B)** versus **(C)**. **(D)** Normalized CDOM absorption coefficients plotted on a log scale for all exudation experiments regardless of experimental conditions, highlighting the similarity in spectral shape (e.g. *S*(300-500) values) for all experiments and time points.



**Supplementary Figure S2.** **(A-C)** Fluorescence intensity of T, A, and C peak, respectively, in Raman Units (RU) normalized to *Sargassum* mass in wet weight per liter (g L-1) versus time (h), where black circles were under LED lights or sunlight with a Plexiglas cover (no UV exposure), orange squares were under natural sunlight (with UV exposure) and gray diamonds were in mid-senescent conditions. Lines of the corresponding colors are linear regressions used to determine FDOM release rates (*R*F values). **(D-I)** Fluorescence intensity (FI) of emission spectra for various exudation conditions where **(D-F)** have an excitation at 270 nm, similar to the A peak excitation, and **(G-I)** have an excitation at 320 nm, similar to the C peak excitation.



**Supplementary Figure S3.** **(A-C)** Fluorescence apparent quantum yield spectra (Φ(λ)) determined during exudation experiments at 12 h (blue lines), 24 h (gold lines) and 36 h (red lines) for tanks under LED lights or sunlight with a Plexiglas cover (no UV exposure) **(A)**, tanks under natural sunlight (with UV exposure) **(B)**, tanks that had no UV exposure but were in mid-senescent conditions **(C)**. **(D-F)** Averaged ± 1 SD Φ(λ) during experiments after 12h **(D)**, 24h **(E)**, and 36h **(F)** incubation where black lines had no UV exposure, orange lines were under natural sunlight and gray lines were in mid-senescent conditions.



**Supplementary Figure S4.** Changes due to irradiation under simulated sunlight in absorbance spectra **(A-C)**, difference absorbance spectra from time 0 **(D-F)**, and **(**difference absorbance spectra normalized to that at time zero **G-I)**. Note: colors reflect irradiation time from 0 to 45 h.



**Supplementary Figure S5.** **(A)** Decay constants, *k* (h-1) for absorbance loss at every wavelength from 250 to 500 nm modeled according to equation 4 for whole water *Sargassum* DOM (orange lines), *Sargassum* SPE-DOM in pure water (blue lines) and SRNOM (black lines). **(B)** Corresponding half-life (h) at each wavelength determined from *k* (h-1). Goodness of fit for first order decay model according to r2 between fit and observed absorbance **(C)** and the χ2 parameter **(D)**.



**Supplementary Figure S6.** **(A)** Fluorescence loss versus emission wavelength between 0 and 20 h of solar simulated irradiation, where colors correspond to excitation wavelengths (nm). **(B-C)** Loss in fluorescence emission for each time point between 0 and 45 h irradiation at an excitation of 348 nm **(B)** and 412 nm **(C)**.



**Supplementary Figure S7.** Fit parameters determined for fluorescence decay of *Sargassum* whole water DOM for every excitation/emission pair according to equation 5 where **(A)** is the fraction 1 (F1), **(B)** is the decay constant of F1, *k*1 (h-1), **(C)** is fraction 2 (F2), and **(D)** is the F2 decay constant, *k*2 (h-1).



**Supplementary Figure S8.** Fluorescence apparent quantum yield spectra (*ϕ*(λ)) versus excitation wavelength over irradiation time for whole water **(A)** *Sargassum* DOM, *Sargassum* SPE-DOM in pure water **(B)**, and SRNOM **(C)**. **(D)** a comparison of initial *ϕ*(λ) (left) and final *ϕ*(λ) after 20 h irradiation (right) for the samples in **(A-C)**.



**Supplementary Figure S9.** Van Krevelen diagrams of CHO formulas that either relatively increased in intensity (red circles) or relatively decreased in intensity (blue circles) between time points listed. Bubble size corresponds to intensity.