Supporting Information

# Impact of peat fire on the soil and the export of dissolved organic carbon in tropical peat soil, Central Kalimantan, Indonesia

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**Table S1.** The assay conditions (substrates, buffer and optimum pH) of these enzymes in this study. MUB: modified universal buffer; MB: mcllvaine buffer.

| Enzymes | Substrate | Buffer | Optimum pH |
|---|---|---|---|
| Phenol oxidase (PO) | 2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfononic acid) diammonium salt | MUB | 2.0 |
| β-glucosidase (β-Glu) | *p*-NP-β-$_D$-glucopyranoside | MB | 5.0 |
| β-xylosidase (β-Xyl) | *p*-NP-β-$_D$-xylopyranoside | MUB | 5.0 |
| β-galactosidase (β-Gal) | *p*-NP-β-$_D$-galactopyranoside | MB | 5.0 |
| α-mannosidase (α-Man) | *p*-NP-α-$_D$-mannopyranoside | MB | 5.0 |
| *N*-acethyl-glucosaminidase (NAG) | *p*-NP-*N*-acetyl-β-$_D$-glucosaminide | MB | 5.0 |
| Acid phosphatase (AcP) | *p*-NP-β-$_D$-phosphate disodium salt hexahydrate | MUB | 6.5 |
| Alkaline phosphatase (AlP) | *p*-NP-β-$_D$-phosphate disodium salt hexahydrate | MUB | 11.0 |
| Phosphodiesterase (PD) | Bis(*p*-NP)phosphate sodium salt | MUB | 6.5 |

**Table S2.** Pysico-chemical properties of Indonesian peat soils.

| | Site code | Location | Year | Sample depth (cm) | pH ($H_2O$) | pH (KCl) | EC (mS $cm^{-1}$) | Particle density (g $cm^{-3}$) | Moisture content (%) | Ignition loss (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Unburned site (UB) | UB1 | 2º 19' 48.50" S, 113º 54' 18.10" E | 2010 | 30-50 | 3.25 | 2.13 | 2.70 | 0.89 | 78.4 | 70.8 |
| | | | 2011 | 0-20 | No data | No data | No data | No data | 81.7 | No data |
| | | | 2011 | 30-50 | 3.41 | 2.01 | 1.66 | 1.05 | 86.0 | 81.0 |
| | | | 2012 | 0-20 | No data | No data | No data | No data | 77.4 | No data |
| | | | 2012 | 30-50 | 3.09 | 1.93 | 0.35 | 1.22 | 81.8 | 81.4 |
| | UB2 | 2º 20' 18.11" S, 113º 53' 47.37" E | 2010 | 30-50 | 3.05 | 2.15 | 1.72 | 0.83 | 80.2 | 83.8 |
| | | | 2011 | 0-20 | No data | No data | No data | No data | 73.1 | No data |
| | | | 2011 | 30-50 | 3.04 | 2.15 | 0.92 | 0.83 | 81.2 | 81.3 |
| | UB3 | 2º 21' 8.60" S, 114º 2' 12.90" E | 2010 | 30-50 | 3.15 | 2.04 | 0.82 | 0.80 | 79.0 | 76.9 |
| | | | 2011 | 0-20 | No data | No data | No data | No data | 80.9 | No data |
| | | | 2011 | 30-50 | 3.08 | 2.18 | 0.75 | 1.01 | 79.1 | 86.6 |
| | | | 2012 | 0-20 | No data | No data | No data | No data | 75.7 | No data |
| | | | 2012 | 30-50 | 3.46 | 1.91 | 0.46 | 1.09 | 78.1 | 80.7 |
| Burned site (B) | B1 | 2º 20' 50.60" S, 114º 2' 17.90" E | 2010 | 30-50 | 3.31 | 2.14 | 0.89 | 0.95 | 76.4 | 70.7 |
| | | | 2011 | 0-20 | No data | No data | No data | No data | 39.0 | No data |
| | | | 2011 | 30-50 | 2.77 | 1.80 | 0.76 | 1.24 | 74.0 | 75.6 |
| | | | 2012 | 0-20 | No data | No data | No data | No data | 29.5 | No data |
| | | | 2012 | 30-50 | 3.71 | 1.85 | 0.13 | 1.20 | 83.2 | 78.9 |
| | B2 | 2º 20' 47.50" S, 114º 0' 59.80" E | 2010 | 30-50 | 3.39 | 1.89 | 0.88 | 0.91 | 73.1 | 72.7 |
| | | | 2011 | 0-20 | No data | No data | No data | No data | 31.9 | No data |
| | | | 2011 | 30-50 | 2.86 | 1.76 | 0.50 | 1.16 | 79.9 | 71.2 |
| | | | 2012 | 0-20 | No data | No data | No data | No data | 26.9 | No data |
| | | | 2012 | 30-50 | 3.45 | 1.69 | 0.26 | 1.27 | 70.9 | 73.2 |
| | B3 | 2º 18' 28.90" S, 114º 1' 36.20" E | 2010 | 30-50 | 3.06 | 1.89 | 0.84 | 1.02 | 78.9 | 69.4 |
| | | | 2011 | 0-20 | No data | No data | No data | No data | 40.0 | No data |
| | | | 2011 | 30-50 | 2.89 | 1.88 | 0.67 | 1.29 | 82.1 | 78.4 |
| | | | 2012 | 0-20 | No data | No data | No data | No data | 29.5 | No data |
| | | | 2012 | 30-50 | 3.49 | 1.75 | 0.27 | 1.28 | 81.2 | 72.9 |
| | B4 | 2º 17' 41.40" S, 114º 1' 58.00" E | 2010 | 30-50 | 2.95 | 1.95 | 3.42 | 1.06 | 74.9 | 61.2 |
| | | | 2011 | 0-20 | No data | No data | No data | No data | 45.2 | No data |
| | | | 2011 | 30-50 | 2.75 | 1.84 | 0.68 | 0.93 | 65.9 | 79.8 |
| | | | 2012 | 0-20 | 4.00 | 1.92 | 0.29 | 1.24 | 20.5 | 71.1 |
| | | | 2012 | 30-50 | 3.45 | 1.78 | 0.29 | 1.37 | 80.9 | 74.4 |
| | B5 | 2º 16' 47.30" S, 113º 55' 14.40" E | 2011 | 0-20 | 5.81 | 5.55 | 4.34 | 1.58 | 42.7 | 46.1 |
| | | | 2011 | 30-50 | 3.26 | 2.40 | 1.20 | 1.20 | 77.9 | 81.6 |
| | | | 2012 | 0-20 | 4.80 | 3.00 | 0.13 | 1.39 | 55.6 | 67.1 |
| | | | 2012 | 30-50 | 3.92 | 2.22 | 0.16 | 1.33 | 77.9 | 82.3 |

**Table S3.** The elemental composition and atomic ratio (H/C, O/C and C/N) of the unburned soil (UB1 and 3), burned soil (B1– 5) and the thermally treated samples.

| | | Elemental composition (%) | | | | | | Atomic ratio | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample code | year | C | H | N | O | S | Ash | H/C | O/C | C/N |
| UB1 (subsurface) | 2010 | 29.5 | 4.7 | 0.7 | 46.3 | 0.1 | 18.7 | 1.9 | 1.2 | 48 |
| | 2011 | 51.9 | 5.2 | 1.2 | 41.4 | 0.0 | 0.3 | 1.2 | 0.6 | 49 |
| | 2012 | 51.6 | 5.4 | 1.6 | 40.9 | 0.0 | 0.4 | 1.3 | 0.6 | 39 |
| UB3 (subsurface) | 2010 | 36.4 | 5.6 | 1.3 | 51.9 | 0.2 | 4.7 | 1.8 | 1.1 | 33 |
| | 2011 | 52.3 | 5.5 | 1.3 | 40.2 | 0.0 | 0.7 | 1.2 | 0.6 | 48 |
| | 2012 | 51.3 | 5.6 | 1.7 | 41.0 | 0.0 | 0.4 | 1.3 | 0.6 | 36 |
| B1 (subsurface) | 2010 | 47.8 | 5.6 | 1.0 | 42.2 | 0.2 | 3.2 | 1.4 | 0.7 | 55 |
| | 2011 | 57.0 | 5.2 | 0.6 | 36.8 | 0.0 | 0.5 | 1.1 | 0.5 | 114 |
| | 2012 | 54.2 | 5.1 | 0.8 | 39.6 | 0.0 | 0.3 | 1.1 | 0.6 | 82 |
| B2 (subsurface) | 2010 | 43.8 | 5.1 | 0.6 | 46.2 | 0.1 | 4.2 | 1.4 | 0.8 | 81 |
| | 2011 | 53.9 | 4.6 | 0.6 | 40.2 | 0.0 | 0.8 | 1.0 | 0.6 | 112 |
| | 2012 | 51.9 | 4.8 | 0.9 | 38.0 | 0.0 | 4.3 | 1.1 | 0.6 | 67 |
| B3 (subsurface) | 2010 | 47.0 | 5.3 | 0.8 | 45.1 | 0.2 | 1.7 | 1.3 | 0.7 | 70 |
| | 2011 | 54.8 | 4.7 | 0.6 | 39.4 | 0.0 | 0.5 | 1.0 | 0.5 | 103 |
| | 2012 | 54.8 | 4.9 | 0.8 | 38.9 | 0.0 | 0.5 | 1.1 | 0.5 | 79 |
| B4 (subsurface) | 2010 | 53.2 | 5.4 | 0.9 | 38.5 | 0.2 | 1.8 | 1.2 | 0.5 | 70 |
| | 2011 | 54.3 | 5.5 | 0.9 | 36.9 | 0.0 | 2.4 | 1.2 | 0.5 | 74 |
| | 2012 | 54.7 | 4.8 | 0.8 | 38.8 | 0.0 | 0.8 | 1.1 | 0.5 | 78 |
| B5 (surface) | 2011 | 16.8 | 1.7 | 0.5 | 13.4 | 0.0 | 67.7 | 1.2 | 0.6 | 41 |
| | 2012 | 55.5 | 4.6 | 2.1 | 33.5 | 0.0 | 4.4 | 1.0 | 0.5 | 31 |
| B5 (subsurface) | 2011 | 45.6 | 4.1 | 0.6 | 32.0 | 0.0 | 17.7 | 1.1 | 0.5 | 83 |
| | 2012 | 55.6 | 5.3 | 0.9 | 36.6 | 0.0 | 1.6 | 1.1 | 0.5 | 71 |
| Thermally treated samples | | | | | | | | | | |
| 90 ºC 60 min | | 53.7 | 5.0 | 1.3 | 39.7 | 0.0 | 0.3 | 1.1 | 0.6 | 50 |
| 120 ºC 60 min | | 53.7 | 5.2 | 1.3 | 39.2 | 0.0 | 0.6 | 1.2 | 0.6 | 48 |
| 150 ºC 60 min | | 53.2 | 5.1 | 1.3 | 39.9 | 0.0 | 0.5 | 1.1 | 0.6 | 48 |
| 175 ºC 60 min | | 55.1 | 5.0 | 1.5 | 38.1 | 0.0 | 0.4 | 1.1 | 0.5 | 44 |
| 180 ºC 60 min | | 56.0 | 5.0 | 1.6 | 37.1 | 0.0 | 0.4 | 1.1 | 0.5 | 42 |
| 190 ºC 60 min | | 57.0 | 4.8 | 1.6 | 36.2 | 0.0 | 0.4 | 1.0 | 0.5 | 42 |
| 200 ºC 1 min | | 54.2 | 5.2 | 1.4 | 38.9 | 0.0 | 0.3 | 1.1 | 0.5 | 44 |
| 200 ºC 5 min | | 54.6 | 5.1 | 1.5 | 38.6 | 0.0 | 0.3 | 1.1 | 0.5 | 44 |
| 200 ºC 30 min | | 58.8 | 4.5 | 1.6 | 34.6 | 0.0 | 0.5 | 0.9 | 0.4 | 42 |
| 200 ºC 60 min | | 60.9 | 4.0 | 1.8 | 33.0 | 0.0 | 0.3 | 0.8 | 0.4 | 39 |
| 200 ºC 120 min | | 61.5 | 3.9 | 1.9 | 32.2 | 0.0 | 0.6 | 0.8 | 0.4 | 38 |
| 250 ºC 1 min | | 60.4 | 4.5 | 1.7 | 33.0 | 0.0 | 0.4 | 0.9 | 0.4 | 42 |
| 250 ºC 5 min | | 60.5 | 4.2 | 1.7 | 33.1 | 0.0 | 0.5 | 0.8 | 0.4 | 42 |
| 250 ºC 30 min | | 62.8 | 4.1 | 1.8 | 30.9 | 0.0 | 0.4 | 0.8 | 0.4 | 40 |
| 250 ºC 60 min | | 63.2 | 3.6 | 2.1 | 30.8 | 0.0 | 0.5 | 0.7 | 0.4 | 36 |
| 250 ºC 120 min | | 63.3 | 3.2 | 2.1 | 30.7 | 0.0 | 0.7 | 0.6 | 0.4 | 35 |
| 350 ºC 60 min | | 64.2 | 3.3 | 2.3 | 29.4 | 0.0 | 0.9 | 0.6 | 0.3 | 33 |
| 480 ºC 60 min | | 62.3 | 3.1 | 3.4 | 28.9 | 0.0 | 2.3 | 0.6 | 0.4 | 21 |

**Table S4.** The assigments for the peak identified in the Py-TMAH-GC/MS analyses of soils. C: Compounds derived from *p*-hydroxyphenol (cinnamyl) structures; G: Compounds derived from guaiacyl structures; S: Compounds derived from syringyl structures; O: Other non-lignin derived compounds; F: Fatty acids methyl esters.

| No | Compound Name | Origin | No. | Compound Name | Origin |
|---|---|---|---|---|---|
| 1 | Phenol | O | 18 | 3,4,5-Trimethoxybenzoic acid, methyl ester | S |
| 2 | 1,2,3-Trimethylbenzene | O | 19 | 1,6-Anhydro-β-D-glucopyranose | O |
| 3 | 4-Methoxytoluene | C | 20 | 3,4-Dimethoxybenzoic acid, methyl ester | G |
| 4 | 2-Methylphenol | O | 21 | 4,8-Dimethyl-1-nonanol | O |
| 5 | 4-Methoxybenzaldehyde | C | 22 | 3-(3,4-dimethoxyphenyl)-2-Propenoic acid, methyl ester | G |
| 6 | 4-Methoxyphenol | O | 23 | 11-Octadecenoic acid, methyl ester | F |
| 7 | Benzoic acid, methyl ester | O | 24 | Hexadecanoic acid, methyl ester | F |
| 8 | 4-Methylphenol | O | 25 | 17-methyl-Octadecanoic acid, methyl ester | F |
| 9 | 2-Methoxy-4-methylphenol | G | 26 | 12,15-Octadecadienoic acid, methyl ester | F |
| 10 | 2,3-Dimethoxytoluene | G | 27 | 15-Tetracosenoic acid, methyl ester | F |
| 11 | 3,4-Dimethoxytoluene | G | 28 | 17-Octadecenoic acid, methyl ester | F |
| 12 | 3,4-Dimethoxystyrene | G | 29 | Tetracosanoic acid, methyl ester | F |
| 13 | 4-Methoxybenzoic acid, methyl ester | C | 30 | Octadecanoic acid, methyl ester | F |
| 14 | 1,3,5-Trimethyoxybenzene | O | 31 | Pentacosanoic acid, methyl ester | F |
| 15 | 3-Allyl-6-methoxyphenol | O | 32 | Hexacosanoic acid, methyl ester | F |
| 16 | Dodecanoic acid, methyl ester | F | 33 | Octacosanoic acid, methyl ester | F |
| 17 | 1-(3,4-dimethoxyphenyl)-ethanone | G | 34 | Ursolic acid, methyl ester | O |

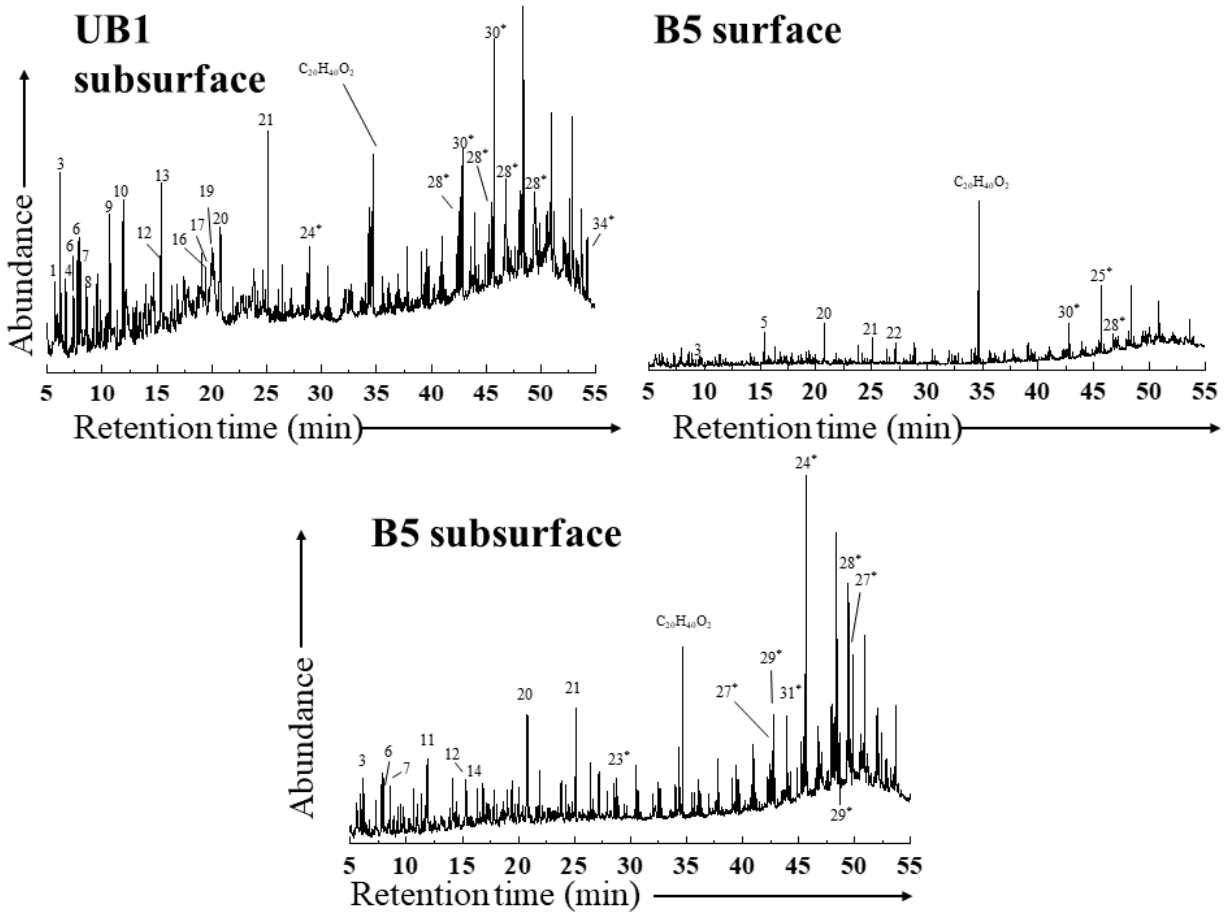


**Figure S1.** Pyrograms total ion chromatograms from Indonesian peat soils collected from UB1 (subsurface), B5 (surface and subsurface) in 2011. Number on the peaks corresponds to the pyrolysis compounds listed in Table S3. Asterisks represent Fatty acids. $C_{20}H_{40}O_2$: nonadecanoic acid methyl ester in acetone internal standard (ISTD).

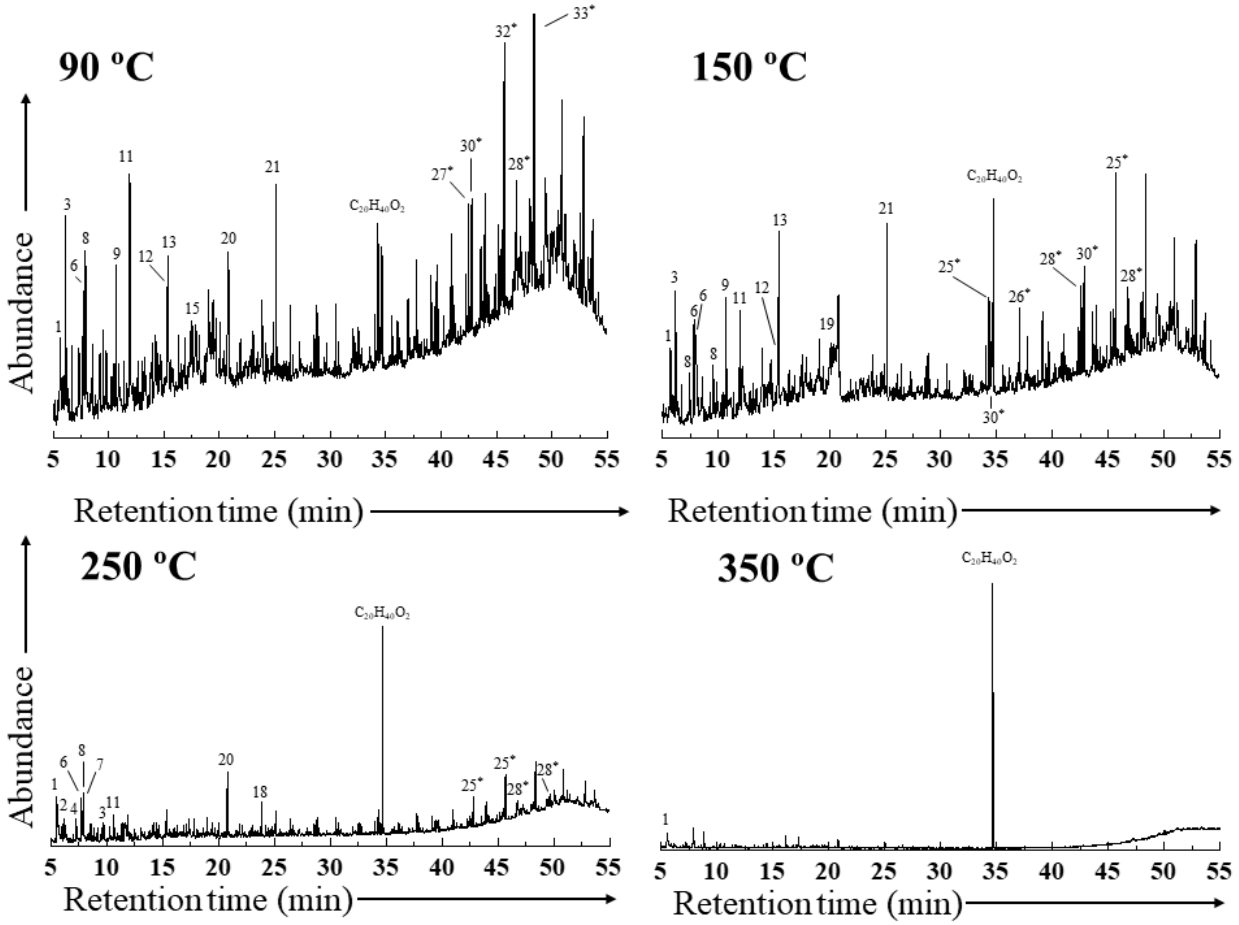


**Figure S2.** Pyrograms total ion chromatograms from thermally treated samples (90 ºC, 150 ºC, 250 ºC and 350 ºC for 60 min). Number on the peaks corresponds to the pyrolysis compounds listed in Table S3. Asterisks represent Fatty acids. $C_{20}H_{40}O_2$: nonadecanoic acid methyl ester in acetone internal standard (ISTD).

**Table S4.** The assigments for the peak identified in the Py-TMAH-GC/MS analyses of soils. C: Compounds derived from *p*-hydroxyphenol (cinnamyl) structures; G: Compounds derived from guaiacyl structures; S: Compounds derived from syringyl structures; O: Other non-lignin derived compounds; F: Fatty acids methyl esters.

| No | Compound Name | Origin | No. | Compound Name | Origin |
|---|---|---|---|---|---|
| 1 | Phenol | O | 18 | 3,4,5-Trimethoxybenzoic acid, methyl ester | S |
| 2 | 1,2,3-Trimethylbenzene | O | 19 | 1,6-Anhydro-β-D-glucopyranose | O |
| 3 | 4-Methoxytoluene | C | 20 | 3,4-Dimethoxybenzoic acid, methyl ester | G |
| 4 | 2-Methylphenol | O | 21 | 4,8-Dimethyl-1-nonanol | O |
| 5 | 4-Methoxybenzaldehyde | C | 22 | 3-(3,4-dimethoxyphenyl)-2-Propenoic acid, methyl ester | G |
| 6 | 4-Methoxyphenol | O | 23 | 11-Octadecenoic acid, methyl ester | F |
| 7 | Benzoic acid, methyl ester | O | 24 | Hexadecanoic acid, methyl ester | F |
| 8 | 4-Methylphenol | O | 25 | 17-methyl-Octadecanoic acid, methyl ester | F |
| 9 | 2-Methoxy-4-methylphenol | G | 26 | 12,15-Octadecadienoic acid, methyl ester | F |
| 10 | 2,3-Dimethoxytoluene | G | 27 | 15-Tetracosenoic acid, methyl ester | F |
| 11 | 3,4-Dimethoxytoluene | G | 28 | 17-Octadecenoic acid, methyl ester | F |
| 12 | 3,4-Dimethoxystyrene | G | 29 | Tetracosanoic acid, methyl ester | F |
| 13 | 4-Methoxybenzoic acid, methyl ester | C | 30 | Octadecanoic acid, methyl ester | F |
| 14 | 1,3,5-Trimethyoxybenzene | O | 31 | Pentacosanoic acid, methyl ester | F |
| 15 | 3-Allyl-6-methoxyphenol | O | 32 | Hexacosanoic acid, methyl ester | F |
| 16 | Dodecanoic acid, methyl ester | F | 33 | Octacosanoic acid, methyl ester | F |
| 17 | 1-(3,4-dimethoxyphenyl)-ethanone | G | 34 | Ursolic acid, methyl ester | O |

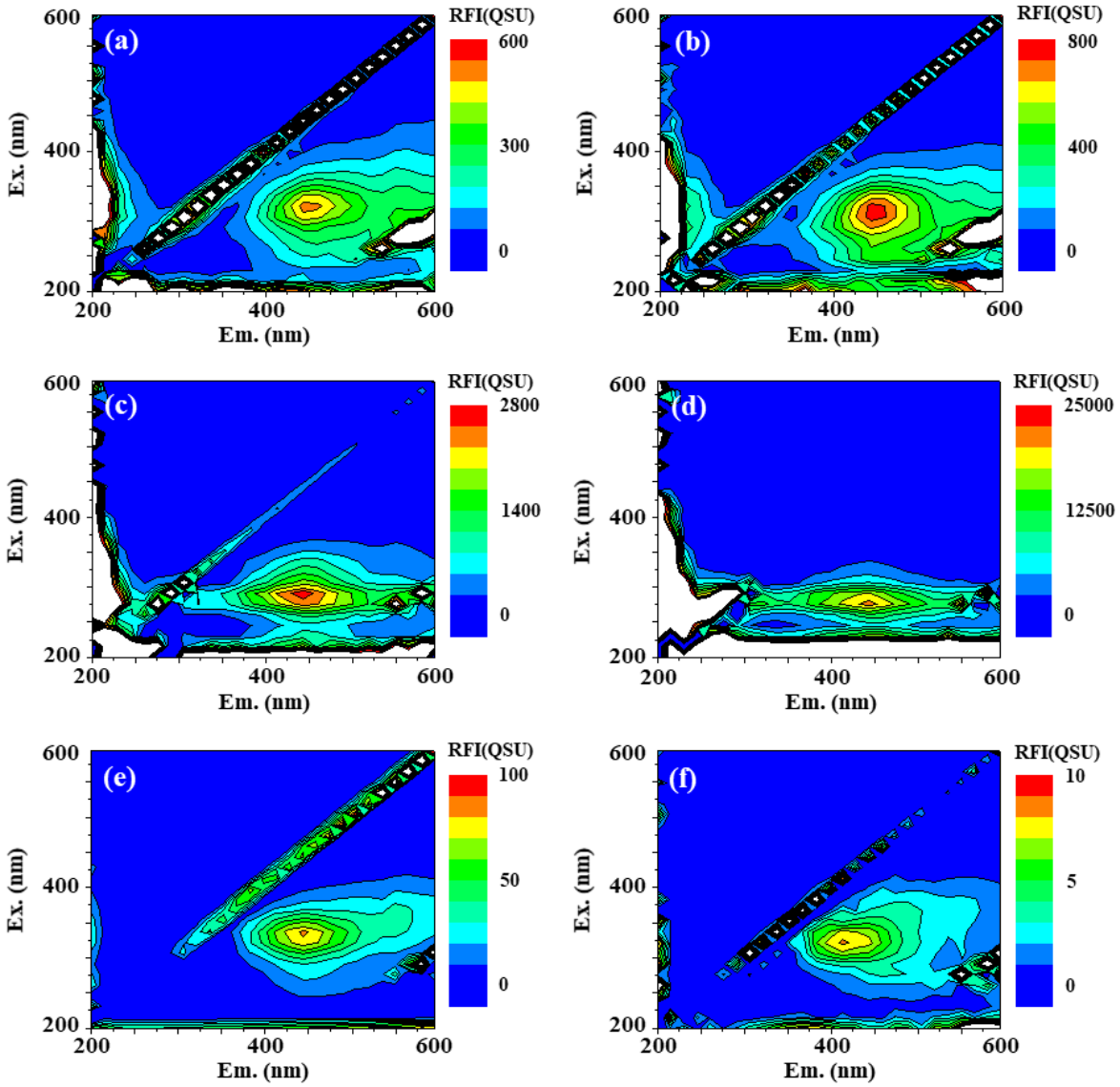


**Figure S3.** The 3DEEM fluorescence spectrum of water-extracted from (a) UB1 at subsurface in 2011 and thermally treated samples ((b) 120 ºC, (c) 150 ºC (d) 175 ºC (e) 200 ºC (f) 250 ºC for 60min).