Supplementary Materials

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Contact Angle Measurements

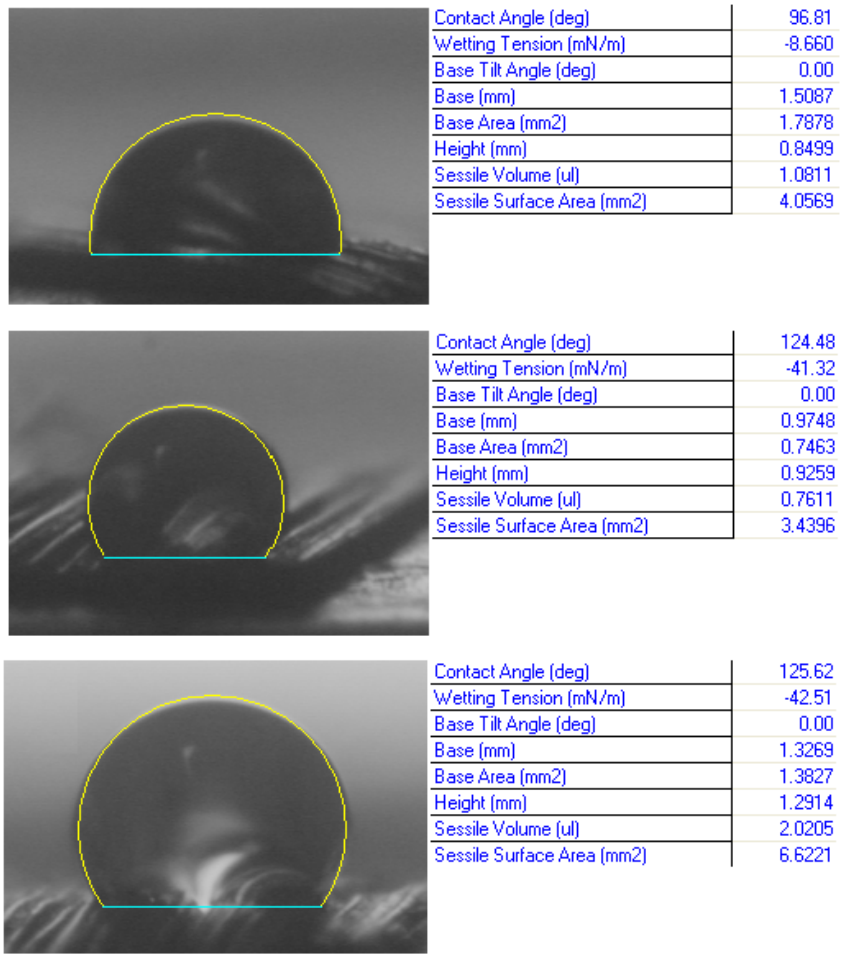

Figure S1. Charred hay samples on drop shape analyzer with deionized water.

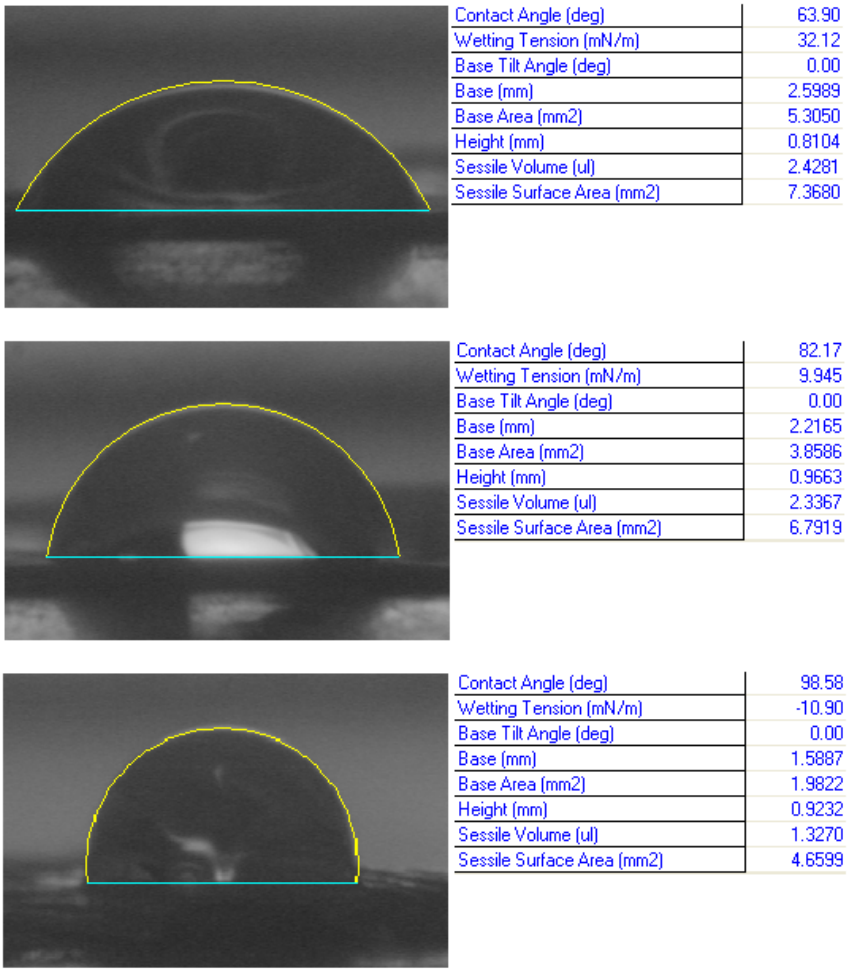

Figure S2. Raw hay samples on drop shape analyzer with deionized water.

Statistical Analysis of the Residual Oil Concentrations

Table S1. Anova: Two-Factor Analysis without Replication.

Summary	*Count*	*Sum*	*Average*	*Variance*
Bitumen	2	75	37.5	180.5
Bitumen + raw hay	2	112	56.0	32.0
Bitumen + charred hay	2	75	37.5	544.5
Bitumen + CaO	2	36	18.0	0
Bitumen + CaO-coated raw hay	2	40	20.0	2.0
Bitumen + CaO-coated charred hay	2	81	40.5	264.5
Instant Ocean Solution	6	250	41.7	339.5
Deionized fresh water	6	169	28.2	155.0

Table S2. Anova Analysis.

Source of Variation	*SS*	*df*	*MS*	*F*	*p-Value*	*F Crit*
Rows	1995.417	5	399.0833	4.185457	0.071097	5.050329
Columns	546.75	1	546.75	5.734137	0.062033	6.607891
Error	476.75	5	95.35			
Total	3018.917	11				

Since the *p*-value for the rows = 0.071 > 0.05 = α (or $F = 4.2 < 5.1 = F\text{-}crit$) we can't reject the null hypothesis, and so at the 95% level of confidence we conclude there is no significant difference in the yields produced by the different treatments.

Since the *p*-value for the columns = 0.062 > 0.05 = α (or $F = 5.7 < 6.6 = F\text{-}crit$) we can't reject the null hypothesis, and so at 95% level of confidence, we conclude there is no significant difference in the yields for fresh *versus* salt water.

If we consider 0.10 = α, we reject the null hypothesis, and so at 90% level of confidence, we can conclude there is a significant different in the results depending on both treatment and salinity.

ICP-MS Summary

Table S3. Vanadium Analyses.

Run – Vanadium	Sanple Code	51V (ppb)	51V (ppb)
DI water (Blank)	DI water	1.50 (±1.479%)	
DI water + bitumen	NJ1-85-DB	1.33 (±1.054%)	−0.17
Green straw + bitumen + DI water	NJ1-85-GSBD	1.15 (±1.435%)	−0.35
Charred straw + bitumen + DI water	NJ1-85-CSBD	1.00 (±1.909%)	−0.50
DI water + calcium oxide sprinkled bitumen	NJ1-85-DBC	1.20 (±3.415%)	−0.30
Green straw + calcium oxide + bitumen + DI water	NJ1-85-GSCBD	0.98 (±1.789%)	−0.52
Charred straw + calcium oxide + bitumen + DI water	NJ1-85-CSCBD	1.07 (±1.381%)	−0.43
Instant ocean solution (Blank)	Instant water	62.03 (±2.254%)	60.53
Instant ocean solution + bitumen	NJ1-85-IB	60.05 (±2.356%)	58.55
Green straw + bitumen + Instant Ocean solution	NJ1-84-GSBI	69.46 (±9.347%)	67.96
Charred straw + bitumen + Instant Ocean solution	NJ1-84-CSBI	79.66 (±7.662%)	78.16
Instant ocean solution + calcium oxide + bitumen	NJ1-85-IBC	112.4 (±4.954%)	110.9
Green straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-GSCBI	119.8 (±1.814%)	118.3
Charred straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-CSCBI	108.8 (±4.844%)	107.3

Column D—Sample values after subtracting the background.

Table S4. Chromium Analyses.

Run – Chromium	Sanple Code	52Cr (ppb)	52Cr (ppb)
DI water (Blank)	DI water	16.77 (±1.278%)	
DI water + bitumen	NJ1-85-DB	19.59 (±1.639%)	2.82
Green straw + bitumen + DI water	NJ1-85-GSBD	18.48 (±0.476%)	1.71
Charred straw + bitumen + DI water	NJ1-85-CSBD	19.12 (±1.612%)	2.35
DI water + calcium oxide sprinkled bitumen	NJ1-85-DBC	31.32 (±1.51%)	14.55
Green straw + calcium oxide + bitumen + DI water	NJ1-85-GSCBD	24.62 (±1.401%)	7.85
Charred straw + calcium oxide + bitumen + DI water	NJ1-85-CSCBD	17.26 (±0.453%)	0.49
Instant ocean solution (Blank)	Instant water	18.45 (±2.749%)	1.68
Instant ocean solution + bitumen	NJ1-85-IB	16.16 (±2.03%)	−0.61
Green straw + bitumen + Instant Ocean solution	NJ1-84-GSBI	16.71 (±2.945%)	−0.06
Charred straw + bitumen + Instant Ocean solution	NJ1-84-CSBI	15.50 (±3.271%)	−1.27
Instant ocean solution + calcium oxide + bitumen	NJ1-85-IBC	35.02 (±0.603%)	18.25
Green straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-GSCBI	34.00 (±3.1%)	17.23
Charred straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-CSCBI	14.40 (±0.539%)	−2.37

Column D—Sample values after subtracting the background.

Table S5. Manganese Analyses.

Run – Manganese	Sanple Code	55Mn (ppb)	55Mn (ppb)
DI water (Blank)	DI water	2.18 (±1.4%)	
DI water + bitumen	NJ1-85-DB	21.18 (±1.246%)	19.00
Green straw + bitumen + DI water	NJ1-85-GSBD	45.52 (±0.658%)	43.34
Charred straw + bitumen + DI water	NJ1-85-CSBD	18.49 (±1.884%)	16.31
DI water + calcium oxide sprinkled bitumen	NJ1-85-DBC	2.01 (±2.115%)	−0.17
Green straw + calcium oxide + bitumen + DI water	NJ1-85-GSCBD	11.48 (±1.231%)	9.30
Charred straw + calcium oxide + bitumen + DI water	NJ1-85-CSCBD	7.60 (±1.369%)	5.42
Instant ocean solution (Blank)	Instant water	31.38 (±1.318%)	29.20
Instant ocean solution + bitumen	NJ1-85-IB	31.62 (±0.778%)	29.44
Green straw + bitumen + Instant Ocean solution	NJ1-84-GSBI	141.1 (±3.265%)	138.9
Charred straw + bitumen + Instant Ocean solution	NJ1-84-CSBI	207.4 (±12.37%)	205.2
Instant ocean solution + calcium oxide + bitumen	NJ1-85-IBC	1.91 (±2.19%)	−0.27
Green straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-GSCBI	4.95 (±2.238%)	2.77
Charred straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-CSCBI	49.71 (±0.625%)	47.53

Column D—Sample values after subtracting the background.

Table S6. Cobalt Analyses.

Run – Cobalt	Sanple Code	59Co (ppb)	59Co (ppb)
DI water (Blank)	DI water	1.05 (±0.744%)	
DI water + bitumen	NJ1-85-DB	0.95 (±0.835%)	−0.10
Green straw + bitumen + DI water	NJ1-85-GSBD	0.91 (±2.263%)	−0.14
Charred straw + bitumen + DI water	NJ1-85-CSBD	0.75 (±2.786%)	−0.30
DI water + calcium oxide sprinkled bitumen	NJ1-85-DBC	2.42 (±10.94%)	1.37
Green straw + calcium oxide + bitumen + DI water	NJ1-85-GSCBD	3.36 (±0.408%)	2.31
Charred straw + calcium oxide + bitumen + DI water	NJ1-85-CSCBD	2.67 (±2.431%)	1.62
Instant ocean solution (Blank)	Instant water	1.70 (±5.388%)	0.65
Instant ocean solution + bitumen	NJ1-85-IB	1.74 (±2.719%)	0.69
Green straw + bitumen + Instant Ocean solution	NJ1-84-GSBI	1.94 (±3.103%)	0.89
Charred straw + bitumen + Instant Ocean solution	NJ1-84-CSBI	1.64 (±1.724%)	0.59
Instant ocean solution + calcium oxide + bitumen	NJ1-85-IBC	3.17 (±1.092%)	2.12
Green straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-GSCBI	3.99 (±1.678%)	2.94
Charred straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-CSCBI	2.16 (±0.745%)	1.11

Column D—Sample values after subtracting the background.

Table S7. Copper (63) Analyses.

Run – Copper 63	Sanple Code	63Cu (ppb)	63Cu (ppb)
DI water (Blank)	DI water	86.69 (±0.68%)	
DI water + bitumen	NJ1-85-DB	25.77 (±2.973%)	−60.92
Green straw + bitumen + DI water	NJ1-85-GSBD	38.56 (±1.629%)	−48.13
Charred straw + bitumen + DI water	NJ1-85-CSBD	34.08 (±2.05%)	−52.61
DI water + calcium oxide sprinkled bitumen	NJ1-85-DBC	23.65 (±0.92%)	−63.04
Green straw + calcium oxide + bitumen + DI water	NJ1-85-GSCBD	78.18 (±1.23%)	−8.51
Charred straw + calcium oxide + bitumen + DI water	NJ1-85-CSCBD	70.18 (±0.526%)	−16.51
Instant ocean solution (Blank)	Instant water	230.6 (±3.353%)	143.9
Instant ocean solution + bitumen	NJ1-85-IB	200.9 (±2.794%)	114.2
Green straw + bitumen + Instant Ocean solution	NJ1-84-GSBI	207.3 (±2.469%)	120.6
Charred straw + bitumen + Instant Ocean solution	NJ1-84-CSBI	181.0 (±1.191%)	94.3
Instant ocean solution + calcium oxide + bitumen	NJ1-85-IBC	187.7 (±1.229%)	101.0
Green straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-GSCBI	198.9 (±3.429%)	112.2
Charred straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-CSCBI	189.2 (±0.756%)	102.5

Column D—Sample values after subtracting the background.

Table S8. Copper (65) Analyses.

Run – Copper 65	Sanple Code	65Cu (ppb)	65Cu (ppb)
DI water (Blank)	DI water	87.61 (±0.939%)	
DI water + bitumen	NJ1-85-DB	25.29 (±2.64%)	−62.32
Green straw + bitumen + DI water	NJ1-85-GSBD	38.78 (±1.957%)	−48.83
Charred straw + bitumen + DI water	NJ1-85-CSBD	33.91 (±2.364%)	−53.70
DI water + calcium oxide sprinkled bitumen	NJ1-85-DBC	25.58 (±0.141%)	−62.03
Green straw + calcium oxide + bitumen + DI water	NJ1-85-GSCBD	82.15 (±2.307%)	−5.46
Charred straw + calcium oxide + bitumen + DI water	NJ1-85-CSCBD	71.75 (±0.921%)	−15.86
Instant ocean solution (Blank)	Instant water	43.46 (±1.759%)	−44.15
Instant ocean solution + bitumen	NJ1-85-IB	33.97 (±1.634%)	−53.64
Green straw + bitumen + Instant Ocean solution	NJ1-84-GSBI	40.32 (±3.641%)	−47.29
Charred straw + bitumen + Instant Ocean solution	NJ1-84-CSBI	29.33 (±0.234%)	−58.28
Instant ocean solution + calcium oxide + bitumen	NJ1-85-IBC	33.44 (±0.804%)	−54.17
Green straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-GSCBI	52.95 (±1.707%)	−34.66
Charred straw + calcium oxide + bitumen + Instant Ocean	NJ1-84-CSCBI	37.83 (±0.209%)	−49.78

Column D—Sample values after subtracting the background.

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