

MILLSAPS COLLEGE

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On:

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Test Type:

ASTM F 726-12:
Oil Adsorption – Short Test (Sections 9.3, 9.3.2, and 9.3.2.1)
Oil Adsorption – Long Test (Sections 9.4, and 9.4.1.1)
Dynamic Degradation – (Sections 9.2, 9.2.2, and 9.2.2.1)
Reuse – (Sections 10, 10.2.1.1, and 10.2.1.2)

Subject: Sorbency Evaluation

Osprey Spill Control submitted a cellulose based sorbent product to the Millsaps College Sorbent and Environmental Laboratory for sorbency testing using American Society for Testing and Materials (ASTM) F 726 – 12, *Standard Test Method for Sorbent Performance of Adsorbents*. The particulate sorbent is classified as a Type II sorbent by ASTM. The tests performed were:

- Oil Adsorption – Short Test (Sections 9.3, 9.3.2, and 9.3.2.1)
- Oil Adsorption – Long Test (Sections 9.4, and 9.4.1.1)
- Dynamic Degradation – (Sections 9.2, 9.2.2, and 9.2.2.1)
- Reuse – (Sections 10, 10.2.1.1, and 10.2.1.2)

Prior to testing the sorbent was disaggregated using a hand mixer to ensure that the cellulose insulation material was not compacted as shipped (Figure 1).

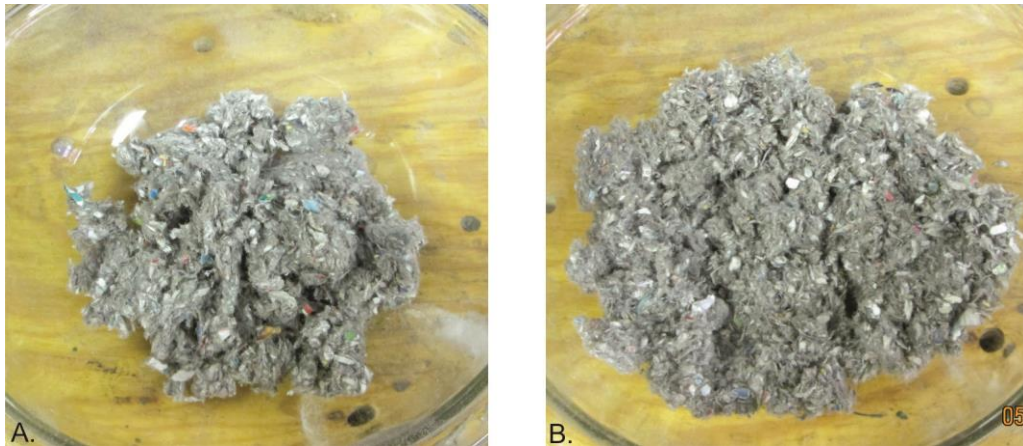


Figure 1. Osprey Spill Control Cellulose Adsorbent. A. Compacted as shipped, B. Blended. Scale in images is approximately the same.

Short and long sorbency tests were conducted using #2 diesel fuel, Hydrocal 300 petroleum oil, and Calsol 8240 petroleum oil. The degradation test was done using Hydrocal 300 and the reuse test was conducted in used motor oil.

Sorbency is a ratio of the grams of fluid adsorbed relative to the mass of the dry sorbent. A sorbency of 18.11 indicates that a sorbent is capable of adsorbing just over 18 times its weight in test fluid under test conditions. All tests were done in triplicate in each of the oils. The sorbency is reported as the average of the three tests. Sorbency testing was routine, two samples in Calsol 8240 did not totally saturate during the 15 minute test, which is common in high density or high viscosity fluids. The short and long sorbency values are summarized in Table 1. The full data for each test are presented in the Appendices A and B.

Table 1. Short and Long Test Sorbency.

	<u>Short Test</u>	<u>Long Test</u>
<u>Diesel (0.848 g/cm³)</u>	18.06 ± 0.22	18.11 ± 0.52
<u>Used Motor Oil (0.875 g/cm³)</u>	18.47 ± 0.76	NA
<u>Hydrocal 300 (0.903 g/cm³)</u>	21.83 ± 1.65	24.60 ± 0.27
<u>*Calsol 8240 (0.932 g/cm³)</u>	26.02 ± 3.94	30.66 ± 3.07

* Not all samples fully saturated during 15 min. test.

Table 1

The dynamic degradation test was done using only medium weight oil (Hydrocal 300) as per ASTM F726-12 protocol, raw data appears in the Appendix C. The Osprey adsorbent passed the test and featured a water sorbency, or take-up, is 9.47 ± 0.48 . None of the larger particles settled to the bottom of the test jar and much less than 10% of the sorbent sample settled to the bottom of the test jar. Most of the fines that did drop below the surface still remained in suspension following to the 2 minute post-test observation (Figure 2). The Osprey sorbent readily adsorbed the 3 mL of Hydrocal 300 added; no sheen was observed on top of the water.

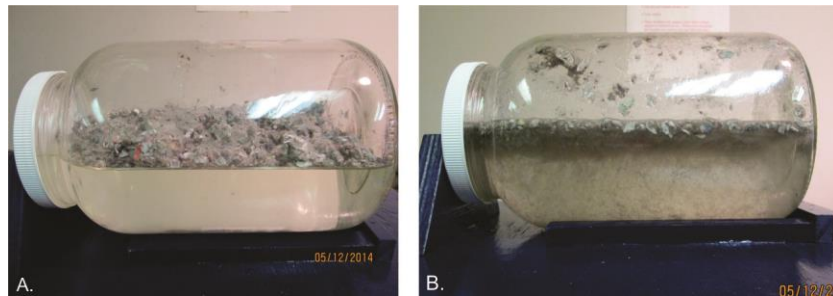


Figure 2. Osprey Spill Control Cellulose Adsorbent. Dynamic Degradation Test. A. Pre-test, B. Two minutes post-test prior to water sorbency measurement.

An informal test was done using diesel fuel on water. The sorbent was applied to a volume of diesel fuel on water at approximately 50% short test sorbency average. Once the sorbent was added, the shaker table was operated at 150 cycles/min for 15 minutes. Within 10 seconds most of the diesel had been adsorbed. The table was stopped and the volume of diesel fuel was increased to 70% of the short test sorbency. At the end of the 15 minute cycle the Osprey adsorbent adequately adsorbed the diesel fuel and remained on the surface (Figure 3).

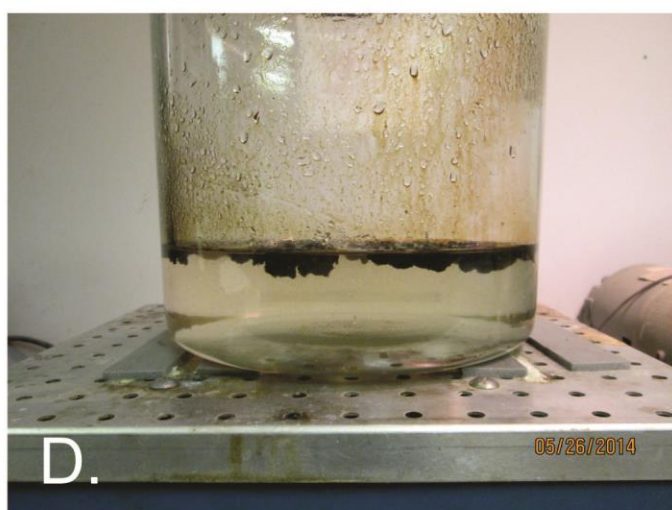
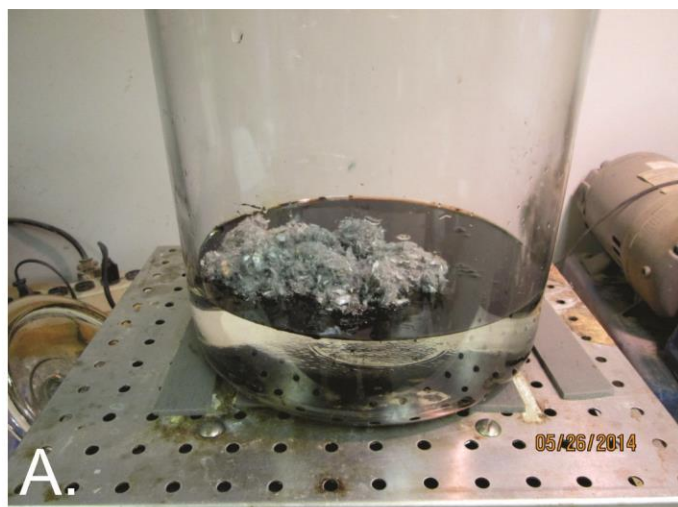


Figure 3. Osprey Spill Control Cellulose Sorbent - Diesel on Water Test. A. on diesel, B. after 10 sec., C. during test, D. 2 min post-test, and E. 2 min post-test viewed from the top of the test jar.

Although the reuse test is not typically used for Type II sorbents, the Osprey adsorbent was evaluated on one compression and re-sorption cycle as described in ASTM F726-12. The medium weight fluid used was motor oil. After the sorbency was determined as described in the short test, the sorbent was placed on a porous polymer board. Pressure equivalent to 70 kPa (10.15 lb/in²) was applied to a top plate for 15 seconds. The sorbent was re-weighed and then placed in test fluid for a second sorbency determination (Figure 4).

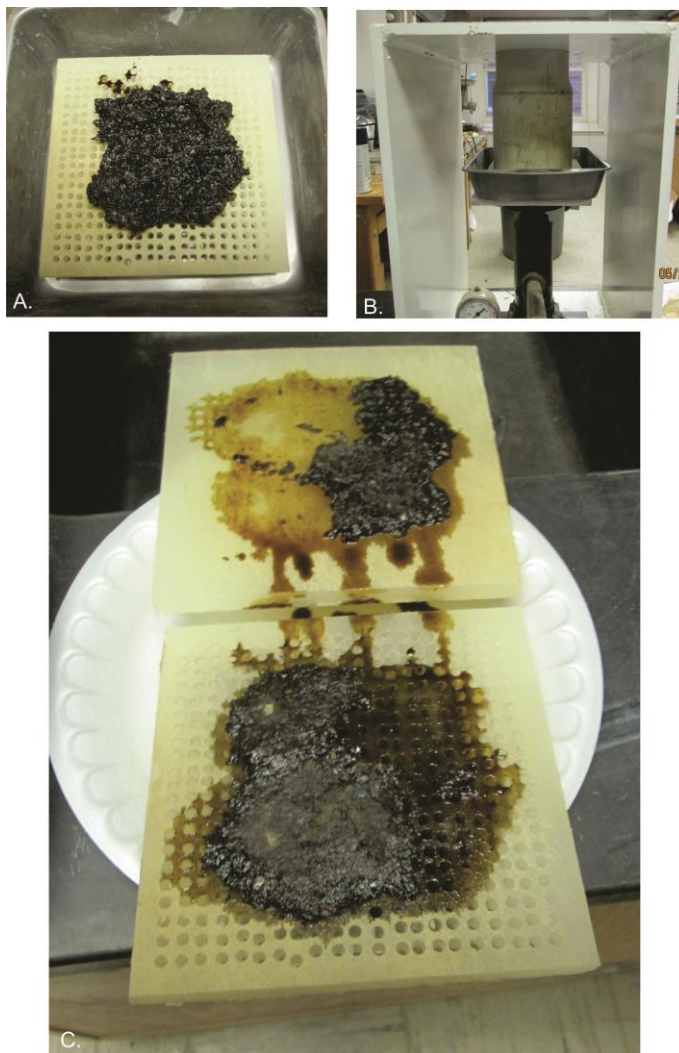


Figure 4. Osprey Spill Control Cellulose Sorbent - Reuse Test. A. Adsorbent on porous plate, B. Sample in hydraulic press, C. Sample following 15 second compression.

Results of the reuse test are displayed in Appendix D. and summarized in Table 2. The re-sorption sorbency of the Osprey adsorbent was 77% of its initial sorbency average.

Table 2. Reuse Test Summary

	<u>Sorbency Average (g/g)</u>	<u>Oil Retained (%)</u>	<u>Second Sorbency (g/g)</u>
Osprey Spill Control	18.47 ± 0.76	27.59	14.27

Osprey Spill Control							
Sorbency Tests - 5-2014							
Short Test - Basket							
Test Fluid: Diesel Fuel							
Fluid Density: 0.848 g/cm ³							
	Basket (g)	Sorbent (g)	Sorbent + Basket + Oil (g)	Oil (g)	Sorbency (g/g)		Basket + Oil (g)
1	26.41	4.01	101.90	71.48	17.83		28.2
2	26.41	4.02	103.14	72.71	18.09		28.15
3	26.41	4.02	103.86	73.43	18.27		22.88
					Average ± St. Dev.	18.06 ± 0.22	26.41
Test Fluid: Hydrocal 300							
Fluid Density: 0.903 g/cm ³							
	Basket (g)	Sorbent (g)	Sorbent + Basket + Oil (g)	Oil (g)	Sorbency (g/g)		Basket + Oil (g)
1	34.48	4.03	131.83	93.32	23.16		34.82
2	34.48	4.02	118.87	80.37	19.99		34.68
3	34.48	4.03	128.76	90.25	22.39		33.94
					Average ± St. Dev.	21.85 ± 1.65	34.48
Test Fluid: Calsol 8240*							
Fluid Density: 0.932 g/cm ³							
	Basket (g)	Sorbent (g)	Sorbent + Basket + Oil (g)	Oil (g)	Sorbency (g/g)		Basket + Oil (g)
1	46.63	4.00	138.97	88.34	22.09		46.31
2	46.63	4.07	156.65	105.95	26.03		47.09
3	46.63	4.01	170.77	120.13	29.96		46.49
					Average ± St. Dev.	26.02 ± 3.94	46.63
Samples did not fully saturate during 15 min. test.							

Appendix A. Millsaps College Sorbent and Environmental Laboratory. ASTM F726-12, Short Test sorbency results.

Osprey Spill Control									
Sorbency Tests - 5-2014									
Long Test - Basket									
Test Fluid: Diesel Fuel									
Fluid Density: 0.848 g/cm ³									
	Basket (g)	Sorbent (g)	Sorbent + Basket + Oil (g)	Oil (g)	Sorbency (g/g)				
1	25.47	4.00	103.54	74.07	18.52				
2	25.11	4.10	104.22	75.01	18.30				
3	23.99	4.19	101.64	73.46	17.53				
						Average ± St. Dev.		18.11 ± 0.52	
Test Fluid: Hydrocal 300									
Fluid Density: 0.903 g/cm ³									
	Basket (g)	Sorbent (g)	Sorbent + Basket + Oil (g)	Oil (g)	Sorbency (g/g)				
1	28.45	4.77	149.79	116.57	24.44				
2	28.45	4.24	136.42	103.73	24.46				
3	28.67	4.38	142.16	109.11	24.91				
						Average ± St. Dev.		24.60 ± 0.27	
Test Fluid: Calsol 8240									
Fluid Density: 0.932 g/cm ³									
	Basket (g)	Sorbent (g)	Sorbent + Basket + Oil (g)	Oil (g)	Sorbency (g/g)				
1	48.36	4.01	177.18	124.81	31.12				
2	46.58	4.06	186.53	135.89	33.47				
3	48.36	4.02	162.46	110.08	27.38				
						Average ± St. Dev.		30.66 ± 3.07	

Appendix B. Millsaps College Sorbent and Environmental Laboratory. ASTM F726-12, Long Test sorbency results.

Osprey Spill Control											
Sorbency Tests - 5-2014											
Reuse Test											
Test Fluid: Used Motor Oil											
Fluid Density: 0.875 g/cm ³											
	Basket (g)	Sorbent (g)	Sorbent + Basket + Oil (g)	Oil (g)	Sorbency (g/g)		Pressed (g)	Oil Retained (%)	Sorbent + Basket + Oil (g)	Sorbency (g/g)	Basket + Oil (g)
1	29.76	4.06	106.60	72.78	17.93		27.33	31.97	101.58	16.69	29.96
2	29.76	4.00	111.12	77.36	19.34		20.67	21.55	84.42	12.67	29.77
3	29.76	4.03	106.94	73.15	18.15		25.42	29.24	88.04	13.46	29.54
				Average ± St. Dev.	18.47 ± 0.76			27.59		14.27	29.76

Appendix C. Millsaps College Sorbent and Environmental Laboratory. ASTM F726-12, Reuse test results.

Osprey Spill Control							
Sorbency Tests - 5-2014							
Dynamic Degradation Test 5-2014							
Test Fluid: Hydrocal 300							
	<u>Sorbent (g)</u>	<u>Sorbent + Water (g)</u>	<u>Water (g)</u>	<u>Water Sorbency (g/g)</u>			
1	7.99	84.73	76.74	9.60			
2	9.88	98.22	88.34	8.94			
3	9.56	103.95	94.39	9.87			
				Average	9.47	±	0.48

Appendix D. Millsaps College Sorbent and Environmental Laboratory. ASTM F726-12, Dynamic Degradation test results.