

Support Information

Ultrasoft Gelatin Aerogels for Oil Contaminant

Removal

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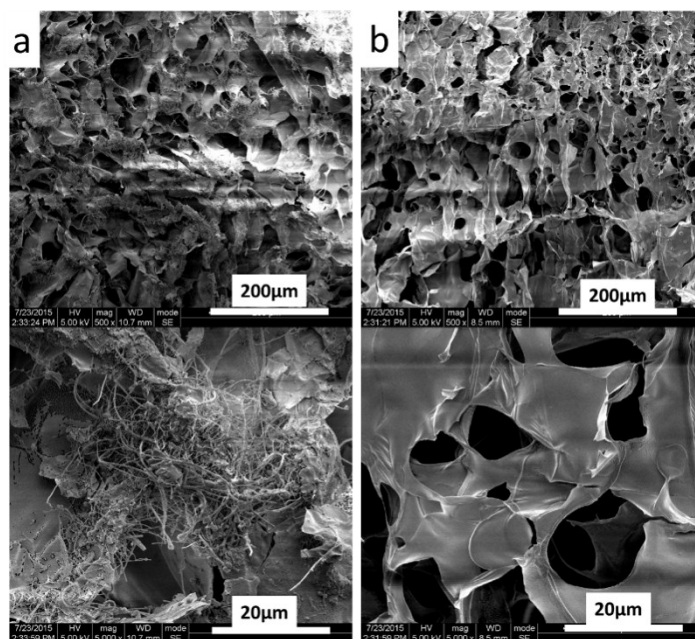


Fig. S1 SEM photographs of the MTCS-cGels: (a) surface (up) and its zoom-in (down); (b) cryo-fractured surface (up) and its zoom-in (down).

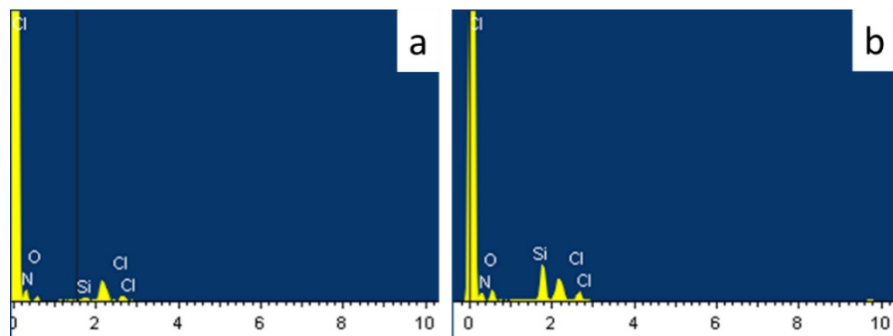


Fig. S2 EDX spectra of the MTCS-cGel aerogel: cryo-fractured surfaces (a) and outer surface (b).

Table S1. The comparison of oil absorbent materials demonstrated in recent years.

Absorbent Material	Production Process	Absorption Capacity (g/g)	Reusability and Method	Renewability	Biodegradability	Ref
PS/PU Fibers	1. Dissolving PS and diluting PU resin 2. Electrospinning	Motor oil~64	Squeezing: Motor oil~60% after 5 cycles	N	N	20
TiO ₂ -coated PU Sponge	1.Initial PU sponge soaking in TiO ₂ sol 2.Centrifugation and drying	Motor oil~105 Gasoline~103 Diesel~87.4 Crude oil~114.9	Squeezing: Motor oil ~75% after 12 cycles	N	N	17
Hydrophobic PU Sponge	1.PU sponges were ultrasonically cleaned in acetone and ethanol 2.Immersing PU sponge in MTCS/hexane solution and drying	Crude oil~24 Gasoline~16	None	N	N	18
Silanized Melamine Sponges	1. Silanization of commercial melamine sponge by immersing in a octadecyltrichlorosilane/toluene solution 2. Fresh toluene washing by sorption-squeezing process and drying	Chloroform~163 Toluene~96.2 Diesel~93.6	Squeezing: Diesel~93.4 % after 100 cycles	N	N	42
Superhydrophobic MF Sponge	1.Depositing of a thin layer of polydopamine (PDA) films on MF sponge 2.Immersion of the PDA-coated MF sponge into an (1H,1H,2H,2H-perfluorodecanethiol)/ethanolic solution	Chloroform~195 n-hexane~79 Cyclohexane~94 Pump oil~90	Squeezing: Cyclohexane ~91% after 100 cycles	N	N	23
Bacterial Cellulose Aerogels	1.Bacterial Cellulose 2.Freeze-drying 3.Hydrophobic modification in	Gasoline~95 Paraffin oil~95 Chloroform~180	Compression -rinsing- freeze drying Diesel~100%	Y	Y	33

	MTCS/CH ₂ Cl ₂		after 10 cycles			
Nanofibrillated Cellulose Aerogel	<ol style="list-style-type: none"> 1. Homogenized with an inline Ultra-Turrax system 2. Fibrillation 3. Centrifugation 4. Silylated NFC by mixing NFC and polysiloxane sol (MTMS) 5. Freeze-drying 	Dodecane~55 Chloroform~100 Silicon oil~70 Motor oil~50	Rinsing-freeze drying Dodecane~90% after 10 cycles	Y	Y	34
Nanocellulose Aerogels	<ol style="list-style-type: none"> 1. Hardwood kraft pulp mechanically homogenized to form Nanocellulose hydrogel 2. Freeze-drying 3. Coated with TiO₂ using atomic layer deposition 	Chloroform~40 Paraffin oil~27 Octane~22	Drying: Toluen~100% after 10 cycles	Y	Y	32
Nanofibrillated Cellulose Aerogel	<ol style="list-style-type: none"> 1. Chemical treatments 2. High-intensity ultrasonication 3. Freeze-drying 4. Hydrophobic coating by MTCS (CVD) 	Oil~52	None	Y	Y	36
Cellulose Nanofibril Aerogels	<ol style="list-style-type: none"> 1. Cellulose isolated from rice straw 2. TEMPO oxidation 3. Defibrillation 4. Freeze-drying 5. Hydrophobic coating by triethoxyl(octyl) silane (CVD) 	Chloroform~356 Decane~219 Pump oil~230	Distillation: Toluen~48%, Octane~61%, Cyclohexane ~57%, after 6 cycles	Y	Y	35
Microfibrillated Cellulose Fibers Aerogel	<ol style="list-style-type: none"> 1. Separation into individual cellulose fibers by deflaker 2. Microfibrillation of cellulose fibers 3. Freeze-drying 4. Hydrophobic coating by MTMS 	pump oil~197, motor oil~198 silicone oil~228	Squeezing" Pump oil 61% after 30 cycles	Y	Y	37

	(CVD)					
PVA/CNF Aerogel	<ol style="list-style-type: none"> 1. TEMPO-oxidation 2. Refining in a disk refiner and centrifugation 3. Microfluidization 4. Preparation of crosslinked PVA/CNF aerogels 5. Freeze-drying 6. Hydrophobic coating by MTCS (CVD) 	<p>Gasoline~45</p> <p>Crude oil~64</p> <p>Chloroform~95</p>	None	Y	Y	31
Chitin Aerogel	<ol style="list-style-type: none"> 1. Dissolving chitin in NaOH/urea aqueous by using freezing/thawing cycles 2. Cross-linking by epichlorohydrin 3. Freeze-drying 4. Hydrophobic coating by MTCS (CVD) 	<p>Gasoline~30</p> <p>Chloroform~58</p> <p>Pump oil~37</p>	<p>Rinsing- vacuum drying</p> <p>Toluene~93 % after 10 cycles</p>	Y	Y	38
Carbon Soot Sponge	<ol style="list-style-type: none"> 1. Synthesis of carbon soot (CS) combustion flame process 2. Preparation of CS-sponge by dip-coating of melamine sponge in the CS dispersion 	<p>Toluene~50</p> <p>Crude oil~30</p> <p>Used pump oil~34</p> <p>Pump oil~36</p>	<p>Rinsing- drying:</p> <p>Pump oil~94% after 10 cycles, ~87% after 20 cycles;</p> <p>Squeezing:</p> <p>Pump oil~37% after 2 cycles, ~28% after 4 cycles.</p>	N	N	24
Nitrogen-Rich Carbon Aerogels	<ol style="list-style-type: none"> 1. Preparation of Lignin Particles 2. MF Prepolymer Monomers (pre-MF) 3. Porous PMF aerogels 	<p>Chloroform~12.5</p> <p>Gasoline~7</p> <p>Pump oil~7.5</p>	<p>Distillation:</p> <p>n- hexane~100 % after 100 cycles;</p>	N	N	6

	4. NRC Aerogels by complete pyrolysis		Combustion: n-hexadecane ~65% after 100 cycles.			
BC/rGO Aerogels	1. biosynthesis bacterial cellulose (BC) 2. Fibrillation of BC and ultrasonication 3. Synthesis of GO 4. mixing BC suspension with GO suspension and ultrasonication, freeze-drying 4. reducing at 200 °C under a H2 stream	DMF~136 Cyclohexane~150	None	N	N	30
Carbon Nanofiber Aerogels from BC	1. purified BC pellicles were rinsed and freeze-drying 2. pyrolysis at 700–1300oC under argon atmosphere	Gasoline~180 Chloroform~285	Combustion: Gasolin~59% after 5 cycles; Distillation: 1-octane~100% after 5 cycles;	Y	N	7
Graphene-based Aerogels	1. Preparation of GO 2. Preparation of Cu nanoparticles 3. graphene-based hydrogels 4. freeze-drying	Pump oil~31 Diesel oil~34	None	N	N	27
Spongy Graphene	1. Preparation of GO 2. hydrothermal treatment of colloidal GO dispersion to prepare graphene gel 3. freeze-drying	Chloroform~85 Kerosene~45 Pump oil~77	Heat treatment: Toluene~98% after 10 cycles; Dodecane~9	N	N	5

			3% after 10 cycles.			
Graphene-based Sponges	<p>1. hydrophobic graphene nanosheets were obtained by exfoliation of expanded graphite</p> <p>2. commercial sponge was cleaned ultrasonically with acetone and distilled water successively and dried</p> <p>3. dipping into a dispersion of graphene nanosheets in ethanol</p>	<p>Chloroform~165</p> <p>Hexane~54</p> <p>Pump oil~92</p> <p>Used pump oil~87</p> <p>Motor oil~92</p>	<p>Squeezing:</p> <p>Motor oil~30% after 2 cycles</p>	N	N	28
Nitrogen-Doped Graphene Framework	<p>1.oxidation of the natural graphite powder using a modified Hummers method</p> <p>2. preparation of ultralight N-doped Graphene gel in autoclave</p> <p>3. freeze-dried graphene gel</p> <p>4. heating at 1050 °C for 3h under Ar atmosphere</p>	<p>Cyclohexane~320</p> <p>Chloroform~500</p> <p>Gasoline~280</p>	N	N	N	29
CNT Sponge	<p>1. The CNT sponges were prepared by chemical vapor deposition (CVD)</p>	<p>Diesel oil~112</p> <p>Octane~108</p>	<p>Burning:</p> <p>Diesel oil~36% after 10 cycles;</p> <p>Squeezing:</p> <p>Diesel oil~18% after 10 cycles.</p>	N	N	8
3D Graphene/CNT Hybrid Foam	<p>1.growing graphene on nickel (Ni) foam</p> <p>2. the graphene–Ni substrate is immersed into polyethylene glycol/ethanol solution Ni(NO₃)₂ and dried</p>	<p>Chloroform~105</p> <p>Toluen~125</p>	<p>Rinsing-drying:</p> <p>Toluen~82% after 6 cycles.</p>	N	N	4

	<p>3. CNTs are CVD-grown at 750 1C</p> <p>4. Ni foam was etched away to obtain 3D graphene-CNT hybrid foam</p>					
Hydrophobic cGel aerogel	<p>1. Gelatin crosslinked by formaldehyde</p> <p>2. Freeze drying</p> <p>3. Hydrophobic coating by MTCS (CVD)</p>	<p>Crude oil~70</p> <p>Gasoline~81</p> <p>Keresene~83</p> <p>Silicon oil~118</p> <p>Pump oil~119</p> <p>Waste pump oil~105</p> <p>Paraffin oil~92</p> <p>Toluene~107</p> <p>Chloroform~123</p>	<p>Compression :</p> <p>83% after Compression in kerosene for 5000 times</p>	Y	Y	Our work