

# WATERS SORBENT SELECTION GUIDE

## For Solid-Phase Extraction

### MATRIX KEY



Air



Biological



Food



Petroleum



Soil



Water

SORBENT/SURFACE	COMMON SAMPLE MATRICES	DESCRIPTION	TYPICAL APPLICATIONS*	PROPERTIES
REVERSED-PHASE				
<b>Oasis™ PRiME HLB</b> Patent pending sorbent	   	General purpose reversed-phase sorbent designed to remove 95% of common matrix interferences with faster flows and less plugging. Featuring the unique characteristics of Oasis HLB, this sorbent can be used without conditioning and equilibration steps for aqueous samples. Will not dry out with vacuum or positive pressure flows. Stable in organic solvents.	<ul style="list-style-type: none"><li>The ideal starting sorbent to use for any reversed-phase SPE sample cleanup</li><li>Matrix cleanup of small molecules in biofluids and tissues</li><li>Removal of fats and phospholipids in foods, tissues, and wastewater</li><li>Viscous samples</li></ul>	Patent pending sorbent Cartridge and 96-well plate formats pH range: 1-10
<b>Oasis HLB</b> N-Vinylpyrrolidone-DVB copolymer	   	Water-wettable polymer with unique hydrophilic-lipophilic balance. Reversed-phase retention without condition and equilibration steps for aqueous samples. Will not dry out with vacuum or positive pressure flows. Stable in organic solvents.	<ul style="list-style-type: none"><li>Matrix cleanup of drugs and metabolites in biofluids and extracts</li><li>High capacity for extremely polar compounds</li><li>High throughput biopolymer desalting</li><li>Trace organics, priority pollutants, endocrine disrupters</li><li>JPMHLW* official food methods for antibiotics, pesticides</li></ul>	Particle sizes: 30 and 60 µm Pore size: 80Å Surface area: 830 m²/g pH range: 0-14
<b>Ostro™</b> Proprietary sorbent	 	Silica-based sorbent with C <sub>18</sub> bonding in proprietary coverage. Uses a combination of filtration and sorbent interaction.	<ul style="list-style-type: none"><li>A pass-through sample preparation technique, to retain phospholipids, proteins, and particulates from sample matrices</li></ul>	96-well plate 25 mg sorbent/well Max sample size: 350 µL
<b>Sep-Pak™ tC<sub>18</sub></b> Silica -Si(C <sub>18</sub> H <sub>37</sub> )	   	Strongly hydrophobic, silica-based bonded phase used to adsorb analytes from aqueous solutions. Trifunctional bonding chemistry for increased hydrolytic stability.	<ul style="list-style-type: none"><li>JPMHLW* official methods for pesticides in water</li><li>JPMHLW* official methods for odorants in water</li></ul>	Particle size: 37-55 µm Pore size: 125Å Surface area: 325 m²/g Carbon load: 17% pH range: 2-8
<b>Sep-Pak C<sub>18</sub></b> Silica -Si(CH <sub>3</sub> ) <sub>2</sub> C <sub>18</sub> H <sub>37</sub>	   	Hydrophobic, silica-based bonded phase used to retain phospholipids and proteins. Monofunctional bonding provides alternate selectivity versus tC <sub>18</sub> .	<ul style="list-style-type: none"><li>Lipid fractionation; ganglioside isolation</li><li>Organic acids in fruit juice, wine</li><li>JPMHLW* and CDFA* official methods for pesticides in food</li><li>Natural products</li><li>AOAC* methods for food colors, sugars</li></ul>	Particle size: 55-105 µm Pore size: 125Å Surface area: 325 m²/g Carbon load: 12% pH range: 2-8
<b>Sep-Pak C<sub>8</sub></b> Silica -Si(CH <sub>3</sub> ) <sub>2</sub> C <sub>8</sub> H <sub>17</sub>	   	Moderately hydrophobic, silica-based bonded phase used in methods when less retention than that of HLB or C <sub>18</sub> is required.	<ul style="list-style-type: none"><li>Drugs and their metabolites in biofluids</li><li>Peptides in serum and plasma</li></ul>	Particle size: 37-55 µm Pore size: 125Å Surface area: 325 m²/g Carbon load: 9% pH range: 2-8
<b>Sep-Pak tC<sub>2</sub></b> Silica -SiC <sub>2</sub> H <sub>5</sub>		Weakly hydrophobic, silica-based bonded phase used in methods when less retention than that of C <sub>8</sub> is required. Trifunctional bonding chemistry for increased hydrolytic stability.	<ul style="list-style-type: none"><li>Applications are similar to those of C<sub>18</sub> and C<sub>8</sub></li></ul>	Particle size: 37-55 µm Pore size: 125Å Surface area: 325 m²/g Carbon load: 2.7% pH range: 2-8
REVERSED OR NORMAL-PHASE				
<b>Sep-Pak Aminopropyl</b> Silica -Si(CH <sub>2</sub> ) <sub>3</sub> NH <sub>2</sub>	   	Moderately polar, silica-based bonded phase with weakly basic surface. Can be used as a polar sorbent with different selectivity for acidic/basic analytes or as a weak anion exchanges in aqueous medium below pH 8.	<ul style="list-style-type: none"><li>Phenols, phenolic pigments, natural products</li><li>Petroleum fractionation</li><li>Saccharides</li><li>Drugs and drug metabolites</li><li>JPMHLW* official methods for pesticides in food</li></ul>	Particle size: 55-105 µm Pore size: 125Å Surface area: 325 m²/g Carbon load: 3.5% pH range: 2-8
<b>Sep-Pak PSA</b> -SiC <sub>2</sub> H <sub>4</sub> NHC <sub>2</sub> H <sub>4</sub> NH <sub>2</sub>	    	Silica-based bonded phase containing primary and secondary amines. Similar selectivity to aminopropyl but with higher pK <sub>a</sub> 's and increased ion-exchange capacity.	<ul style="list-style-type: none"><li>Strong affinity for fatty acids, polar pigments, and sugars</li><li>Potential for adsorption by chelation</li></ul>	Particle sizes: 37-55 µm Pore size: 60Å Surface area: 450 m²/g pH range: 2-9 IEX capacity: 1.75 meq/g
<b>Sep-Pak Cyanopropyl</b> Silica -Si(CH <sub>3</sub> )(CH <sub>2</sub> ) <sub>3</sub> CN	  	Silica-based bonded phase with low hydrophobicity can be used as a less polar alternative to silica or as a less hydrophobic alternative to C <sub>18</sub> or C <sub>8</sub> .	<ul style="list-style-type: none"><li>Drugs and their metabolites</li><li>Pesticides</li></ul>	Particle size: 55-105 µm Pore size: 125Å Surface area: 325 m²/g Carbon load: 6.5% pH range: 2-8
<b>Sep-Pak Diol</b> Silica -Si(CH <sub>2</sub> ) <sub>2</sub> OCH <sub>2</sub> CH(OH)CH <sub>2</sub> OH	  	Moderately polar, neutral, silica-based bonded phase. Used in normal-phase applications where acidic character of silica is undesirable or as a weakly hydrophobic phase in aqueous media.	<ul style="list-style-type: none"><li>Antibiotics in cosmetics</li><li>Protein and peptide isolation by HIC [hydrophobic-interaction chromatography]</li></ul>	Particle size: 37-55 µm Pore size: 300Å Surface area: 100 m²/g Carbon load: 2% pH range: 2-8
NORMAL-PHASE				
<b>Sep-Pak Silica</b> SiO <sub>2</sub>	 	Polar sorbent binds analytes in non-aqueous solvents. Also used as an intermediate-strength cation exchanger in aqueous media and as a support for liquid-liquid partition separations.	<ul style="list-style-type: none"><li>Vitamins and food additives</li><li>Lipid classification</li><li>Synthetic organic compounds</li><li>Natural products, plant pigments</li><li>JPMHLW* official methods for pesticides in food</li></ul>	Particle size: 55-105 µm Pore size: 125Å Surface area: 325 m²/g Activity: High [≤3.2% water]
<b>Sep-Pak Florisil™</b> MgO·SiO <sub>2</sub>	  	Polar, highly active, weakly basic sorbent for the adsorption of low to moderately polar species from non-aqueous solutions.	<ul style="list-style-type: none"><li>AOAC* and EPA* official methods for pesticides</li><li>JPMHLW* official methods for pesticides in food</li><li>Polychlorinated biphenyls [PCBs] in transformer oil</li></ul>	Particle size: 50-200 µm Pore size: 60Å Activity: High [≤2.5% slurry] pH of 10% aqueous slurry: 8.5
<b>Sep-Pak Alumina (A,N,B)</b> Al <sub>2</sub> O <sub>3</sub>	   	Highly surface-active polar, acidic [A], neutral [N], and basic [B] sorbents. Exhibits specific pi-electron interactions with aromatic hydrocarbons. Acidic and basic alumina are also low-capacity ion exchangers in aqueous media, unaffected by high-energy radioactivity.	<ul style="list-style-type: none"><li>Petroleum, synthetic crude oil fractionation [N]</li><li>Radioactive compound isolation, isotope generators [A,B]</li><li>Phospholipids, steroids, catecholamines [B]</li><li>Food, feed additives [A,N], synthetic organic compounds [N]</li><li>Pesticide, herbicide, priority pollutant isolation [N,B]</li><li>Alternative to official AOAC* and EPA* methods [A,N,B]</li></ul>	Particle size: 50-300 µm Pore size: 120Å Activity: High, ≤1 on Brockmann scale [≤1.5% water] pH of 10% aqueous slurry: A: 4 N: 7.5 B: 10
DISPERSIVE				
<b>DisQuE™</b> Specific application		Prepackaged centrifuge tubes and pouches containing pre-weighed salts and sorbents. Used for pesticide analysis employing a combination of salting-out LLE and matrix dispersion extraction, commonly referred to as "QuEChERS".	<ul style="list-style-type: none"><li>Food Safety: Monitor commodities for chemical residues to ensure compliance with established regulations</li><li>Food Quality and Manufacture: quality control of manufactured products</li><li>AOAC* Method 2007.01</li><li>CEN* Method 15662</li></ul>	Dimensions: 50 mL extractions tubes and pouches; 2 mL, 5 mL, and 15 mL cleanup tubes Sorbents (available in varying combinations and amounts): Sodium Acetate, MgSO <sub>4</sub> , Trisodium citrate, Dihydrate, Disodium hydrogen citrate sesquihydrate, NaCl, PSA, C <sub>18</sub>
ION-EXCHANGE & MIXED MODE				
<b>Oasis MCX</b> N-Vinylpyrrolidone-DVB copolymer -SO <sub>3</sub> H	   	Mixed-mode, reversed-phase/strong cation-exchange, water-wettable polymer. Highly selective for bases. Stable in organic solvents.	<ul style="list-style-type: none"><li>Aggressive matrix cleanup of basic drugs and metabolites in biofluids and extracts</li><li>Drug Monitoring: screening, identification, confirmation, and quantitation</li><li>Pesticides, herbicides</li></ul>	Particle sizes: 30 and 60 µm Pore size: 80Å Surface area: 830 m²/g pH range: 0-14 [pK <sub>a</sub> : <1] IEX capacity: 1 meq/g
<b>Oasis WCX</b> N-Vinylpyrrolidone-DVB copolymer -COOH	   	Mixed-mode, reversed-phase/weak cation-exchange, water-wettable polymer. Used to retain and release strong bases. Stable in organic solvents.	<ul style="list-style-type: none"><li>Aggressive matrix cleanup of strongly basic compounds and metabolites in biofluids and extracts</li><li>Drug Monitoring: screening, identification, confirmation, and quantitation</li><li>JPMHLW* official method for streptomycin and dihydrostreptomycin in vegetable crops</li></ul>	Particle sizes: 30 and 60 µm Pore size: 80Å Surface area: 830 m²/g pH range: 0-14 [pK <sub>a</sub> : ~5] IEX capacity: 0.75 meq/g
<b>Oasis MAX</b> N-Vinylpyrrolidone-DVB copolymer -CH <sub>2</sub> N(CH <sub>3</sub> ) <sub>2</sub> C <sub>8</sub> H <sub>9</sub> <sup>+</sup>	   	Mixed-mode, reversed-phase/strong anion-exchange, water-wettable polymer. Selective for acids. Stable in organic solvents.	<ul style="list-style-type: none"><li>Aggressive matrix cleanup of acidic drugs and metabolites in biofluids and extracts</li><li>Drug Monitoring: screening, identification, confirmation, and quantitation</li><li>Food additives and contaminants</li></ul>	Particle sizes: 30 and 60 µm Pore size: 80Å Surface area: 830 m²/g pH range: 0-14 [pK <sub>a</sub> : >18] IEX capacity: 0.25 meq/g
<b>Oasis WAX</b> N-Vinylpyrrolidone-DVB copolymer-CH <sub>2</sub> -piperazine	  	Mixed-mode, reversed-phase/weak anion-exchange, water wettable polymer. Used to retain and release strong acids. Stable in organic solvents.	<ul style="list-style-type: none"><li>Aggressive matrix cleanup of strongly acidic drugs and metabolites in biofluids and extracts and tissue extracts</li><li>Drug Monitoring: screening, identification, confirmation, and quantitation</li><li>Emerging contaminants</li></ul>	Particle sizes: 30 and 60 µm Pore size: 80Å Surface area: 830 m²/g pH range: 0-14 [pK <sub>a</sub> : ~6] IEX capacity: 0.6 meq/g
<b>Sep-Pak AccellPlus™ CM</b> Acrylic acid/acrylamide copolymer on diol-silica -COO <sup>-</sup> Na <sup>+</sup>	   	Silica-based, hydrophilic, weak cation exchanger with large pore size used to extract cationic analytes in aqueous and non-aqueous solutions.	<ul style="list-style-type: none"><li>Isolation of cationic proteins</li><li>Pesticides, herbicides</li><li>Steroids</li><li>Inorganic cations in environmental samples</li></ul>	Particle size: 37-55 µm Pore size: 300Å pH range: 2-9 Ligand density: 350 µmol/g Protein-binding capacity: 175 mg Cytochrome c/g
<b>Sep-Pak AccellPlus QMA</b> Acrylamide-acrylic acid copolymer bound to diol-silica -C(O)NH(CH <sub>2</sub> ) <sub>3</sub> N(CH <sub>3</sub> ) <sub>3</sub> <sup>+</sup> Cl <sup>-</sup>	   	Silica-based, hydrophilic, strong anion exchanger with large pore size used to extract anionic analytes in aqueous and non-aqueous solutions.	<ul style="list-style-type: none"><li>Isolation of anionic proteins</li><li>Acidic pigments in wine, fruit juices, food extracts</li><li>Phenolic compounds</li><li>Peptide pool fractionation</li><li>Inorganic anions in environmental samples</li></ul>	Particle size: 37-55 µm Pore size: 300Å pH range: 2-9 Ligand density: 220 µmol/g Protein-binding capacity: 200 mg BSA/g
APPLICATION SPECIFIC				
<b>Sep-Pak DNPH</b> Diphenylhydrazine coated on silica		Acidified dinitrophenylhydrazine reagent coated on silica used for collection of air samples. Aldehydes and ketones react <i>in situ</i> to form hydrazone derivatives; these are then eluted and quantitated by HPLC analysis.	<ul style="list-style-type: none"><li>EPA* Method TO-11A; ASTM* D5197 for carbonyl compounds in air</li><li>JPMOE* Official Methods for aldehydes: odor in outdoor air and in exhaust gas</li></ul>	Particle size: 55-105 µm Pore size: 125Å Recommended maximum capacity: 75 µg [2.5 µmol] formaldehyde/cartridge
<b>Sep-Pak XPoSure™ Aldehyde Sampler</b> Diphenylhydrazine coated on silica		Acidified dinitrophenylhydrazine reagent coated on silica used for collection of air samples. Aldehydes and ketones react <i>in situ</i> to form hydrazone derivatives; these are then eluted and quantitated by HPLC analysis. Larger particle size optimized for low-pressure personal air monitors.	<ul style="list-style-type: none"><li>JPMHLW* official methods for aldehydes in indoor air</li><li>EPA* Methods TO-11A and IP-6A, ASTM* D5197 for carbonyl compounds in air</li><li>NIOSH* Method 2532 for glutaraldehyde in air</li></ul>	Particle size: 500-1000 µm Pore size: 125Å Recommended maximum capacity: 70 µg [2.3 µmol] formaldehyde/cartridge
<b>Sep-Pak Ozone Scrubber</b> Potassium iodide		Potassium iodide cartridge is used in series with Sep-Pak DNPH and XPoSure Aldehyde Sampler cartridges to remove ozone interferences.	<ul style="list-style-type: none"><li>EPA* Method IP-6A and ASTM* D5197 for carbonyl compounds in air</li></ul>	Quantity: 1.4 g KI Capacity: 4.2 mmol ozone/cartridge [theoretical]
<b>Sep-Pak Dry</b> Anhydrous sodium sulfate	    	High-capacity desiccant used to remove residual water from normal-phase SPE extracts [in water-immiscible organic solvents].	<ul style="list-style-type: none"><li>General purpose</li></ul>	Quantity: 2.85 g anhydrous Na <sub>2</sub> SO <sub>4</sub> Theoretical capacity: 3.6 g H <sub>2</sub> O
<b>Sep-Pak PS2</b> Styrene-DVB copolymer	  	Very hydrophobic copolymer designed for multi-residue pesticide analysis in water samples.	<ul style="list-style-type: none"><li>JPMHLW* official methods for pesticides in water</li><li>JPMHLW* official methods for pesticides in food</li></ul>	Particle size: 80 µm
<b>Sep-Pak AC2</b> Activated carbon	  	Highly hydrophobic, low ash content, activated carbon used to remove or enrich very polar organic molecules from water.	<ul style="list-style-type: none"><li>JPMHLW* official method for 1,4-dioxane analysis in water</li><li>Pesticides, herbicides, especially highly polar small molecules</li></ul>	Particle size: 85 µm Quantity: 400 mg/cartridge
<b>Sep-Pak Carbon Black/Aminopropyl</b> Carbon black aminopropyl silica		Two-layer sorbent bed used for pesticide cleanup in food matrices prior to GC analysis.	<ul style="list-style-type: none"><li>JPMHLW* official methods for pesticides in food</li><li>JPMHLW* official method for propham</li></ul>	Particle size: 37-105 µm [carbon black, top layer] 55-105 µm [aminopropyl silica, bottom layer] Quantity: 500 mg of each sorbent, separated by frit
<b>Carbon Black/PSA</b> Primary-secondary amine silica		Two-layer sorbent bed used for pesticide cleanup in food matrices prior to GC analysis. PSA provides alternative selectivity compared to aminopropyl.	<ul style="list-style-type: none"><li>JPMHLW* official methods for pesticides in food</li></ul>	Particle size: 37-105 µm [carbon-black, top layer] 37-55 µm [PSA, bottom layer] Quantity: 500 mg of each sorbent, separated by frit
<b>PoraPak™ RDX</b> DVB-N-Vinylpyrrolidone copolymer	 	Hydrophobic polymer for explosives analysis.	<ul style="list-style-type: none"><li>Explosives in ground and surface water at ppb level</li><li>EPA* Method 8330 for explosives</li></ul>	Particle size: 125-150 µm Pore size: 200Å Typical sample volume: 500 mL water/cartridge



\* AOAC = Association of Official Analytical Chemists; ASTM = American Society for Testing and Materials [International]; CDFA = California Department of Agriculture; EPA = U.S. Environmental Protection Agency; JPMHLW = Japanese Ministry of Health, Labour and Welfare; JPMOE = Japanese Ministry of the Environment; NIOSH = National Institute for Occupational Safety and Health.